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WA #: 063-RICO-02YP

Region 2 RAC2
Remedial Action Contract

Draft Work Plan, Volume 1

San German Groundwater Contamination Site, Operable Unit 2

Remedial Investigation/Feasibility Study

San German, Puerto Rico

May 4, 2016

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SUBJECT:	Draft Work Plan, Volume 1 San German Groundwater Contamination Site Operable Unit 2 San German, Puerto Rico

Dear Ms. Eng and Dr. Bosque:

CDM Federal Programs Corporation (CDM Smith) is pleased to submit this Draft Work Plan Volume 1, for the San German Groundwater Contamination Site, Operable Unit 2 in San German, Puerto Rico.

If you have any questions regarding this work plan, please contact me at your earliest convenience at (212) 785-9123.

Very truly yours,
CDM FEDERAL PROGRAMS CORPORATION

Jeanne Litwin, PMP, REM
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Enclosure

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RAC2 Document Control

REMEDIAL ACTION CONTRACT 2
FOR REMEDIAL RESPONSE, ENFORCEMENT OVERSIGHT,
CRITICAL REMOVAL ACTIVITIES AT SITES OF RELEASE OR
THREATENED RELEASE OF HAZARDOUS SUBSTANCES
IN EPA REGION 2

DRAFT WORK PLAN
VOLUME 1

SAN GERMAN GROUNDWATER CONTAMINATION SITE
OPERABLE UNIT 2
SAN GERMAN, PUERTO RICO
Work Assignment No. 063-RICO-02YP

U.S. EPA CONTRACT NO. EP-W-09-002
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Acronyms

amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirement
ASC	Analytical Services Coordinator
bgs	below ground surface
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
cis-1,2-DCE	*cis*-1,2-dichloroethene
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CO	Contracting Officer
COPC	chemical of potential concern
DESA	Division of Environmental Science and Assessment
DNAPL	dense non-aqueous phase liquid
DQO	data quality objective
DVD	digital video disc
EDD	electronic data deliverable
Eh	oxidation-reduction potential
EPA	United States Environmental Protection Agency
EPAAR	Environmental Protection Agency Acquisition Regulations
EQuIS	Environmental Quality Information Systems
FAR	Federal Acquisition Regulations
FASTAC	Field and Analytical Services Teaming Advisory Committee
FCN	field change notification
FS	feasibility study
gpd	gallon per day
HASP	health and safety plan
HHRA	Human Health Risk Assessment
IDW	investigation derived waste
Lola I	Lola Rodriguez de Tio I
Lola II	Lola Rodriguez de Tio II
MCL	maximum contaminant level
MNA	monitored natural attenuation
MS/MSD	Matrix spike/matrix spike duplicate
NCP	National Contingency Plan
NPL	National Priorities List
ODC	other direct cost
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PCE	tetrachloroethene
PLOE	professional level of effort
PO	project officer
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRDOH	Puerto Rico Department of Health

PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
QAS	quality assurance specialist
QMP	quality management plan
RAC	Remedial Action Contract
RACMIS	RAC Management Information System
RAS	routine analytical services
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	remedial project manager
RSCC	Region 2 Sample Control Center
SIM	selective ion monitoring
SM	site manager
SMO	Sample Management Office
SOW	statement of work
TCE	trichloroethene
TCL	Target Compound List
TDS	total dissolved solids
the Site	San German Groundwater Contamination Site Operable Unit 2
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TSS	total suspended solids
TRC	Technical Review Committee
UFP	Uniform Federal Policy
USGS	United States Geological Survey
VOC	volatile organic compound
µg/kg	microgram per kilogram
µg/L	microgram per liter

Section 1

Introduction

CDM Federal Programs Corporation (CDM Smith) received Work Assignment 063-RICO-02YP under the Remedial Action Contract (RAC) 2 Region 2 (Contract No. EP-W-9-002) to complete for the United States Environmental Protection Agency (EPA) Region 2, the Remedial Investigation/Feasibility Study (RI/FS) to investigate the nature and extent of contamination in groundwater for the San German Groundwater Contamination Site (the Site), Operable Unit (OU) 2 (OU), located in San German, Puerto Rico. The Site has been divided in two operable units. OU-1 addresses identified soil contamination that acts as a continuing source of groundwater contamination, including soil in the vadose zone (above the water table) and soil and highly contaminated groundwater below the water table in the shallow saprolite zone (soils and highly weathered rock). The Record of Decision (ROD) for OU-1 was completed on December 11, 2015. OU-2 addresses the site-wide groundwater contaminated plume.

The objective of this work assignment is to review and evaluate the studies and investigations performed at the Site to date, determine the minimum amount of sampling data necessary to complete characterization of the site-wide groundwater contaminated plume and support the selection of an approach for groundwater remediation, and to use this data in support of the OU-2 Record of Decision (ROD). The human health risk assessment (HHRA) completed for OU-1 will be updated to assess risks associated with the fully delineated plumes and the FS will develop and analyze a range of remedial action alternatives for groundwater through the application of established evaluation criteria, to facilitate selection of the remedy in a ROD, as specified in guidance for site listed under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

1.1 Site Location and Background

The Site is located in the municipality of San German in southwestern Puerto Rico (Figure 1-1). Volatile organic compounds (VOCs) were detected above federal maximum contaminant levels (MCLs) in three public water supply wells: Retiro, Lola Rodriguez de Tio I (Lola I), and Lola Rodriguez de Tio II (Lola II), located south of the Río Guanajibo (Figure 1-2). These wells were part of the Puerto Rico Aqueduct and Sewer Authority (PRASA) San German Urbano water system, which includes a total of seven wells and two surface water intakes.

The Retiro, Lola I, and Lola II wells functioned as an independent, interconnected supply system, with approximately 800 service connections serving approximately 2,280 users in 2005. The Retiro well was located near the intersection of Route 122/Angel Castro Avenue and the Río Guanajibo, along the east side of a narrow, unnamed dirt road that leads to the riverbank; this well was destroyed when a new bridge was constructed across the river. Lola I is located near an entrance to the Lola Rodriguez de Tio public school. Lola II is located approximately 550 feet west-northwest of the former Retiro well, south of the Guanajibo River, on the south side of an unnamed dirt road adjacent to the river. According to PRASA, the individual mean output for each well in 2005 was approximately 398,000 gallons per day (gpd) from Retiro, 185,000 gpd from Lola I, and 170,000 gpd from Lola II (CDM Smith 2015a).

The Site includes an industrial park known as the Retiro Industrial Park, located approximately one-half mile southeast of the affected supply wells (Figure 1-2). Two lots within this industrial park have been determined to be the sources of the VOC contamination in the supply wells. Several of the buildings in the industrial park are occupied by active businesses that were investigated during the OU-1 RI.

From 2001 to 2005, groundwater samples collected quarterly from the Retiro, Lola I, and Lola II wells regularly showed detectable concentrations of tetrachloroethene (PCE) and *cis*-1,2-dichloroethene (*cis*-1,2-DCE). The maximum concentrations of PCE and *cis*-1,2-DCE detected in these wells during this period were 6.4 micrograms per liter (µg/L) and 1.2 µg/L, respectively (CDM Smith 2015a).

The Puerto Rico Department of Health (PRDOH) ordered PRASA to close the Retiro public drinking water supply well in January 2006 because of the VOC contamination in the groundwater. PCE concentrations exceeded the federal MCL of 5 µg/L. PCE was also detected in tap water samples collected from the water distribution system. PRASA responded to this order by taking the Retiro well out of service on January 19, 2006. PRASA also took the Lola I and Lola II wells out of service in about the same time period because of VOCs concentrations in these wells.

Based on the discovery of chlorinated solvents in groundwater supplying drinking water for local residents, EPA added the Site to the National Priorities List (NPL) on March 19, 2008. An RI/FS for OU-1 was completed in 2015 and the ROD was signed on December 11, 2015. EPA executed the OU-1 ROD on December 11, 2015.

1.2 Site Characteristics

1.2.1 Topography

San German is located in the eastern part of the Río Guanajibo floodplain. Within the municipality, the river drops from an elevation of approximately 155 feet above mean sea level (amsl) in the east to approximately 115 feet amsl in the west. The river valley is flanked to the north and south by uplands; the highest point in the area is 735 feet amsl, at a hilltop 0.75 mile south of the public supply wells. Uplands north of the river range to approximately 280 feet amsl. The public supply wells are adjacent to the river on the south side, at an approximate elevation of 138 feet amsl (CDM Smith 2015a).

1.2.2 Geology

The geological characteristics of the San German area are described in the following sections. Regional geological characteristics are based primarily from a United States Geological Society (USGS) Administrative Report titled *Geology and Hydrogeologic Conditions of the San German Groundwater Contamination Site, Southwestern Puerto Rico* (Rodríguez-Martínez and Gómez-Gómez 2007). Site-specific geological descriptions are based on observations and data obtained during the OU-1 field investigations.

1.2.2.1 Regional Geology

The Site lies within the eastern part of the Río Guanajibo floodplain, which is bounded to the north and south by highlands of predominantly igneous rocks and serpentinite. Bedrock is overlain by alluvial deposits within the Río Guanajibo river valley, and is generally encountered at the surface in the highlands and at depths up to 100 feet below the ground surface (bgs) in the river valley. Within the wellfield, the serpentinite is encountered at 30 feet bgs (Rodríguez-Martínez and Gómez-Gómez 2007). The geologic units exposed or underlying the Site are described below, from youngest to oldest.

- Alluvium Soils (Quaternary) – Alluvial deposits occur in the Río Guanajibo river valley and along tributaries, and are made up of sand, clay, and gravel. Deposits are generally less than 100 feet thick.
- Unnamed Unit of Altered Volcanic Rocks (presumably Cretaceous age).
- Sabana Grande Formation (late Cretaceous age) – consists mainly of andesitic tuff and conglomerate with minor basaltic lava breccia.
- Mariquita Chert (late Jurassic and early Cretaceous age) - occurs with rare amygdular basalt and silicified limestone.
- Serpentinite or Serpentinized Peridotite (late Jurassic and early Cretaceous age or older) - highly folded and faulted.

The extent of alluvial deposits and bedrock are illustrated in Figure 1-3.

1.2.2.2 Local Geology

Overburden and Saprolite Zone Geology

The overburden and saprolite observed in OU-1 soil borings are made up of the Quaternary alluvium soils, which consist of stiff silty clay to clay and clayey sand, and weathered saprolite. Bedrock fragments were increasingly present with depth, with the deepest fragments composed largely of olive-brown to olive serpentinite. The overburden and saprolite zone is defined as the geologic materials that can be penetrated with hollow stem augers. The OU-1 shallow monitoring wells are screened near the top of the saprolite, where groundwater is encountered. Serpentinite was generally first observed from 20 and 30 feet bgs in the majority of shallow soil borings. In many OU-1 locations, rock fragments at approximately 10 feet bgs were composed of chert. The overburden and saprolite zone ranges from 68 to 82 feet thick, and transitions to highly weathered bedrock near the contact with the bedrock.

Bedrock Geology

The geologic map of the San German area (Figure 1-3) shows that the Site is located in the Río Guanajibo alluvial valley. Volcanic rocks (Sabana Grande Formation) form uplands to the northeast and southwest of the alluvial valley. The Mariquita Chert forms a prominent upland south of the Wallace buildings in Retiro Industrial Park. The Site is underlain by a highly fractured serpentinite (hydrothermally altered rock) of lower Cretaceous/Upper Jurassic age.

OU-1 Bedrock Borehole Geophysical Logs

Data from the seven OU-1 bedrock borehole geophysical logs indicate the strike and dip of features identified in the acoustic and optical televiewer data from each bedrock borehole. The features were represented as poles to a plane using a southern hemisphere, equal area projection. The stereonets from each OU-1 well are shown in plan-view on Figure 1-4. Table 1-2 summarizes the measured features for each OU-1 borehole from the logs. MPW-9 had the most features measured, at 160; 79 of these features were categorized as bedding or lithology changes with shallow dips and were in the top portion of the open borehole (80 to 135 feet bgs). Conversely, the borehole with the fewest features was the Wallace well in Retiro Industrial Park, with 19 measured. In three of the boreholes (MPW-4, MPW-6, and MPW-10) the mean orientation of the features was toward the northwest; three boreholes (MPW-3, MPW-9, and the Wallace well) had dominant features oriented toward the northeast. Two boreholes (MPW-5 and MPW-7) had features oriented toward the west-northwest. The dips of the features, as measured by the geophysics, were generally greater than 60 degrees, except for MPW-9. The dominant orientation of the measured dipping features was toward the northwest (MPW-4, MPW-5, MPW-6, MPW-7, and MPW-10). Three wells showed dip orientation toward the northeast (MPW-3, MPW-9, and the Wallace well). The most commonly measured features were classified as discontinuous hairline fractures/features.

Supply Well Downhole Video Logs

Downhole video logging was performed in supply wells Lola I and Lola II; both are completed in the fractured bedrock unit. Video logs indicate the following observations.

- Lola I was logged to a depth of 205 feet bgs, at which point an obstruction was encountered. The obstruction was not identified but was noted to possibly be associated with a pump or piping. The Lola I well is open in the bedrock with 10-inch steel casing to approximately 50 feet bgs. The open borehole portion is loose, highly fractured from 72 to 205 feet bgs, and is not plumb.

- Lola II was logged to a depth of 230 feet bgs; loose rocks were observed in the bottom of the borehole. Lola II is open in the bedrock with 12-inch steel casing to approximately 49 feet bgs; the casing is oval or bent at the bottom. The open borehole portion is stable to approximately 190 feet bgs, with several minor fractures occurring from 170 to 180 feet bgs. From 190 to 230 feet bgs, the borehole is highly fractured with several voids.

1.2.3 Hydrogeology

The hydrogeological characteristics of the San German area are described in the following sections, based on the USGS report titled *Geology and Hydrogeologic Conditions of the San German Groundwater Contamination Site, Southwestern Puerto Rico* (Rodríguez-Martínez and Gómez-Gómez 2007). Site-specific descriptions are based on observations and data obtained during the OU-1 field investigations.

1.2.3.1 Regional Hydrogeology

The aquifer within the Site is part of the Río Guanajibo alluvial valley; it is contained predominantly within the poorly to moderately consolidated deposits of sand and gravel of alluvial origin (adjacent to the Río Guanajibo) and in weathered saprolite between the alluvium and bedrock. The colluvial deposits, because of their higher clay and silt content, are less permeable and are generally poor water-bearing units. The groundwater-bearing potential of the underlying bedrock of late Jurassic and Cretaceous age is minimal, except where these units may be highly fractured and weathered (Rodríguez-Martínez and Gómez-Gómez 2007).

Groundwater flow occurs under semi-confined and unconfined conditions. Unconfined conditions predominantly occur in local areas where the alluvium is relatively thin and the thickness of surface and subsurface clays and silt is slight. The occurrence of semi-confining conditions within the saprolite generally increases west of the municipality of San German as the depth to basement rock and the thickness of both surface and subsurface clay and silt strata increase (Rodríguez-Martínez and Gómez-Gómez 2007).

1.2.3.2 Local Hydrogeology

Based on OU-1 investigations, the main aquifer in the vicinity of the Site is the semi-confined saprolite zone aquifer. The depth to water ranges from river level at the Río Guanajibo to about 15 to 20 feet bgs at higher land-surface elevations. The bedrock is also water bearing and the saprolite zone aquifer and bedrock aquifer are connected and form one aquifer.

Groundwater Flow

Aquifer drainage is controlled by the relatively impermeable bedrock units that bound the saprolite zone aquifer along its longitudinal axis. As a result, the general groundwater flow direction is from the highlands toward the Río Guanajibo river valley, and then toward the west within the alluvial valley. Groundwater flow in the area south of the river is, therefore, presumed to be toward the north-northwest. The tributary streams to the Río Guanajibo likely act as aquifer drains.

Potentiometric surface maps were created from OU-1 water level elevation data to illustrate groundwater flow in the saprolite zone and bedrock aquifers. Two rounds of synoptic water level measurements and elevations were completed during the OU-1 field investigations (March 2013 and January 2014) (CDM Smith 2015a). The water levels in the OU-1 monitoring wells, when compared against drilling records of the depth that the water table was first encountered, indicate that the groundwater in some areas of the Site is semi-confined or confined. The difference between final water levels in soil borings compared with the first water encountered ranged from approximately 24 feet bgs to 11 feet bgs, reflecting a rise in water level in the well of 13 feet.

The groundwater potentiometric surface in the saprolite zone aquifer measured during OU-1 investigations is illustrated on Figure 1-5. Groundwater flows toward the northwest, from upland areas near MW-2S and MW-3S, toward MW-10S, located near the Lola I supply well. The groundwater then continues to the northwest toward Lola II and the Río Guanajibo; groundwater then flows westward, following the Río Guanajibo, as shown by water elevations in temporary piezometers along the river. The depiction of groundwater flow on Figure 1-5 is toward the northwest; the depicted flow direction may be influenced by the southeast-northwest alignment of the monitoring wells. The actual flow direction may be more toward the north. The water level at PZ-2, located at the confluence with the tributary, has a slightly higher water level than PZ-1, located upstream. The higher water level in PZ-2 may be caused by water flowing into the river from the tributary.

Groundwater flow in the bedrock aquifer is illustrated in Figure 1-6. Similar to the saprolite zone, the overall flow direction is toward the northwest and the Río Guanajibo and the supply wells. However, the flow direction may be influenced by the alignment of the monitoring wells and may be more toward the north. Groundwater flows through the bedrock along fractures. The water levels within the bedrock are vertically consistent, indicating a high degree of interconnectedness within the aquifer.

Vertical gradients in OU-1 bedrock and saprolite zone well clusters indicate a slight upward gradient during the two rounds of measurements, as evidenced by water levels in shallow/deep well clusters MW-3, MW-5, MW-6, MW-9, and MW-10; the MW-9 and MW-10 clusters are closest to the Río Guanajibo. This upward gradient is consistent with groundwater flow from the upland areas and groundwater discharge in the valley. These levels also indicate that the river was a gaining stream at the time the measurements were taken.

Transmissivity

As discussed by Rodríguez-Martínez and Gómez-Gómez (2007), USGS data indicate that transmissivity in the overburden and saprolite zones in the vicinity of the Site is significantly less than in the lower areas of the Río Guanajibo alluvial valley aquifer because of the reduced thickness of the overburden deposits. The transmissivity may be in the range of 500 to 1,000 square feet per day. This range would be equivalent to hydraulic conductivity values in the range of 5 to 15 feet per day. The higher values are in the alluvial sands and gravels in the areas immediately adjacent to the Río Guanajibo.

During OU-1 field investigations, transmissivity data from the fractured bedrock boreholes was collected during installation of FLUTe blank liners in the open boreholes. The drop tests measure the rate of water pushed into the fractures of the borehole as the liners are installed. The watertight flexible nylon liner is filled with water as it descends into the borehole, thereby pushing water into the formation through the transmissive fractures while simultaneously sealing the permeable features as it descends into the borehole. The rate of descent is used to calculate transmissivity using the Thiem equation for steady radial flow. By recording changes in the rate of descent of the liner, a complete transmissivity profile of the borehole is created (Keller *et al.* 2013). Transmissivity and conductivity rates measured during OU-1 investigations are summarized for each bedrock borehole tested with FLUTe liners in Table 1-3. Results indicate that some boreholes have several zones that are more transmissive, especially in the southeastern part of the Site, while others have fewer transmissive zones. Field observations during sampling indicated that most of the OU-1 multiport monitoring zones had slow recharge.

Aquifer Recharge and Discharge

The net recharge to the aquifer within the study area is entirely from infiltration of rainfall. Rodríguez-Martínez and Gómez-Gómez (2007) estimated that the annual net recharge to the aquifer may be less than one inch per year (about 0.77 inch per year), based on 7Q10 values obtained in the vicinity of Sabana Grande to San German from studies conducted in the early 1990s. 7Q10 is defined as streamflow that occurs over 7 consecutive days and has a 10 year recurrence interval period, or a 1 in 10 chance of occurring for 7 consecutive days in any one year.

The local aquifer is expected to discharge to the public supply wells (when they were pumping), as seepage into the Río Guanajibo, and through evapotranspiration. As of 2006, the PRASA wells have been inactive.

1.2.4 Surface Water/Groundwater Interaction

The Río Guanajibo flows west through the municipality of San German and is the major surface water body in the area. Readings from USGS staff gauge 50131990, located at the Route 119 overpass, indicate that the average flow rate was approximately 220 cubic feet per second and the river depth was approximately 4.5 feet. The Río Guanajibo drainage basin encompasses an area of approximately 35 square miles (USGS http://waterdata.usgs.gov/nwis). A tributary to the Río Guanajibo originates in the highlands southeastern of the Site, and flows west, then north, toward the river, discharging near the northwest corner of the neighborhood between Route 102 and the river.

The interaction between the river and groundwater was investigated during OU-1 field investigations; piezometers were installed in the Río Guanajibo and water level measurements were compared to water levels measured in nearby saprolite monitoring wells. The potentiometric water levels at staff gauge SG-1 and five piezometers located in the Río Guanajibo were very similar to those in the adjacent OU-1 saprolite zone monitoring wells. The water table elevation gradually drops to the level of the river as it flows northwest toward the river, as shown in Figure 1-5. These water levels indicate that the water table aquifer is hydraulically connected to the Río Guanajibo; in this respect, the river is a gaining water body, meaning that groundwater discharges to the surface water. No seeps were observed during the surface water/sediment sampling event. In addition, a low concentration of PCE was detected in a sample collected from a piezometer (PZ-2; Figure 1-5), indicating that the PCE groundwater plume discharges to the river.

1.3 OU-1 RI Results

The RI/FS for OU-1 was completed in December 2015 with the signing of the ROD. A brief summary of the OU-1 investigation results are presented below. Additional details are available in the Final RI Report (CDM Smith 2015a) and the Final FS Report (CDM Smith 2015b)

1.3.1 Source Areas

Two source areas were identified during the OU-1 RI; both are located in El Retiro Industrial Park around buildings occupied by Wallace and CCL Label. Both source areas have significant soil contamination that will be addressed as part of the OU-1 remedy.

Wallace Source Area

The Wallace property has been identified as a source of both soil and groundwater chlorinated VOC contamination. The Wallace soil results were dominated by detections of PCE, which was detected in 37 of 42 samples. Both surface soil, with PCE was as high as 46,000 micrograms per kilogram (μg/kg) (1,000 times the OU-1 screening criterion), and subsurface soil where PCE exceeded its OU-1 screening criterion in samples collected from 20-22 feet bgs just above or near the water table, are contaminated. Other chlorinated VOCs, including trichloroethene (TCE), *cis*-1,2-DCE, and vinyl chloride, were detected in soil samples.

The highest levels of soil contamination were detected in the narrow area where the two Wallace buildings have been connected, and on the south side of the eastern-most building. Groundwater screening samples collected at the top of the water table in soil borings indicated that the soil contamination has migrated into groundwater, forming a significant plume that flows with groundwater toward the northwest. Several soil borings had limited chlorinated VOCs detections in the soil, but had elevated levels of PCE in groundwater. This pattern may indicate that some of the shallow groundwater contamination originates on the southeastern part of the property and has begun to flow with groundwater beneath the buildings.

CCL Label Source Area

The CCL Label property has been identified as a source of both soil and groundwater chlorinated VOC contamination. At the CCL Label source area, soil contamination was dominated by detections of TCE rather than PCE, with TCE detected in 22 of 36 soil samples. Generally, the detections of TCE, PCE, and *cis*-1,2-DCE were low in shallow (less than 10 feet deep) soil samples, with levels increasing with depth. The highest TCE detection was 3,600 μg/kg (100 times the OU-1 screening criterion) in boring CCL-1, adjacent to groundwater screening transect location T2-2. The shallow soil samples had no TCE; the two deeper samples (10-12 feet and 20-22 feet bgs) had high levels of TCE, along with high TCE (27,700 μg/L – more than 5,500 times the OU-1 screening criterion) in the grab groundwater sample.

Overall, contamination was concentrated in two areas, around soil boring CCL-1 near the woods on the east side of the building and around boring CCL-8 near the southeastern end of the building. Other soil borings on the east side of the building had no or very low detections of chlorinated VOCs, indicating that the contaminated soil area may be limited to a few locations on the east side of the building.

1.3.2 Groundwater

Groundwater PCE and TCE plumes have been identified during OU-1 evaluations in the saprolite zone between the source areas in Retiro Industrial Park and the supply wells approximately 3,300 feet to the northwest. Limited contamination was identified in the bedrock zone.

Shallow Saprolite Zone

Waste solvent and/or wastewater were likely discharged to the ground surface at the two source areas resulting in contamination of surface and subsurface soil. If sufficient quantity of solvent/wastewater was discharged, it could reach and contaminate the underlying aquifer. Additionally, precipitation infiltrating through contaminated vadose zone soils could be dissolving and transporting contamination into the groundwater at the source areas. Contaminants have spread in the saprolite zone aquifer with groundwater flow from the source areas.

Separate plumes of PCE and TCE originate at the Wallace and CCL Label source areas, respectively, and then co-mingle as the contaminated groundwater moves downgradient toward the northwest (Figures 1-7 [PCE] and 1-8 [TCE]). The plumes and groundwater movement may have been influenced by pumping at the supply wells when they were in operation (prior to 2006). Although the PCE and TCE plumes are co-mingled, TCE is more dominant on the northern side of the plumes. The TCE observed at and downgradient of the Wallace source area may be a result of biodegradation of the PCE or TCE may have also been used in the buildings as part of the industrial processes.

The PCE/TCE plumes move downgradient with groundwater flow but likely at a slower rate than groundwater movement due to retardation. The PCE and TCE concentrations decrease in the downgradient direction. Near the supply wells, PCE was observed at 7 times its MCL/screening criterion at the downgradient-most samples in groundwater screening transect T10 (at 39.4 μg/L) (Figure 1-9), at 5 times the criterion at MW-10S (at 27 μg/L), and marginally above the criterion in the bedrock ports at MPW-10 (maximum concentration of 7.5 μg/L in port 4 from 124-138 feet bgs). TCE generally did not exceed its MCL/screening criterion further downgradient than the area around MW-6S. However, TCE was detected below the MCL/screening criterion in the downgradient area near the supply wells.

The current groundwater flow direction may be more toward the north, as indicated by the detections of TCE and PCE in several residential wells sampled during the Round 2 event. In addition, a detection of PCE in one pore water sample adjacent to the Río Guanajibo indicates a more northerly flow component and that groundwater discharges to the river at this location.

The monitoring well network, combined with groundwater screening data, shows the contiguous presence of PCE and/or TCE contamination between the source areas and the supply wells. The supply wells had low concentrations of PCE and TCE. Residential wells sampled during OU-1 Round 2 helped delineate contamination on the northern side of the plumes.

Contaminant concentrations in some of the shallow groundwater samples in the source areas may be indicative of the presence of dense non-aqueous phase liquid (DNAPL). DNAPL was not identified or observed during any of the field investigations performed for the OU-1 RI.

Bedrock Zone

Bedrock monitoring well OU-1 results showed little contamination in this part of the aquifer, even in the source areas. However, the monitoring wells form a line between the source areas and the supply wells to confirm a connection between the sources of contamination and the supply wells. Geophysical logs in the bedrock indicated that the fracture zones strike northeast and northwest with dip toward the north. Higher levels of contamination may have moved in down dip directions where no monitoring wells are present, especially down dip of the source areas.

High-angle orthogonal joint sets identified in the geophysical logs may provide a potential groundwater flow path from the source areas in Retiro Industrial Park to the former supply wells Lola I and Lola II, located to the northwest. These high-angle features may also provide sufficient secondary porosity and interconnection to allow groundwater flow to the northwest, especially under the influence of pumping at the former supply wells. The upward gradient from the bedrock to the saprolite zone would tend to limit the potential for vertical downward migration of contaminants into the bedrock.

1.3.3 Surface Water and Sediment

Groundwater is hydraulically connected to local drainages that are tributaries to the Río Guanajibo and to the river. A low concentration of PCE (0.77 µg/L) in a piezometer pore water sample from the river reflects this connection. This detection, however, was below the OU-1 surface water screening criterion. Closer to the source area at CCL Label, PCE, TCE, *cis*-1,2-DCE, and vinyl chloride were detected in surface water samples from an unlined drainage channel adjacent to the industrial park, indicating that either precipitation migrating through contaminated soil or contaminated groundwater may discharge to the small drainage. Some of these detections in the unlined drainage channel exceeded their respective OU-1 screening criteria. The surface water detections were much lower than the monitoring well or groundwater screening samples in the CCL Label building area, indicating the tendency of VOCs to volatize from surface water and to be diluted in the stream flow.

OU-1 sediment sample results indicate that sediments are not significantly impacted by the groundwater or surface water contamination. Low levels (below the OU-1 screening criteria) of *cis*-1,2-DCE and/or vinyl chloride were detected in three samples in the Retiro Industrial Park drainage adjacent to the Former Baytex building. Sediments generally were not impacted by the soil and/or groundwater contamination.

1.4 Groundwater Data Gaps

Groundwater investigations performed for OU-1 resulted in several data gaps in key zones or areas that prevented full delineation of the PCE and TCE plumes between the identified source areas and the former supply wells. The data gaps are listed below along with the additional monitoring wells will be installed to address each data gap as part of the OU-2 RI in order to fully delineate the PCE and TCE plumes and enhance understanding of the hydrogeology at the Site. The data gaps and additional monitoring wells were discussed with EPA in a meeting on October 8, 2015. The OU-1 and proposed monitoring well locations are shown on Figure 3-1.

- Data Gap #1 (down dip DNAPL in bedrock at source areas): Depending on the orientation of fractures in the bedrock, contamination in the bedrock, especially at the source areas where there is potential for DNAPL, may travel in a down dip direction (north) where no monitoring wells are currently located. Therefore, contamination in the bedrock, especially in the source areas, may be more widespread than the current data set indicate. The following OU-2 monitoring wells will address this data gap.
    - One additional bedrock monitoring well to determine if DNAPL moves down dip from the major source area
        - *North/northwest of MW-3S/MPW-3 (in church parking lot) – Single screen bedrock well (approximate depth/well screen: 115 feet bgs/100-110 feet bgs)*
        - *Saprolite well – see Data Gap #5*
- Data Gap #2 (bedrock well near MW-2S at Wallace): At the MW-2S location at the Wallace source area, there was insufficient space to accommodate a large drilling rig for installation of a bedrock monitoring well. Therefore, at this location with the highest OU-1 PCE

concentrations in monitoring well samples (13,000 µg/L) and screening samples (26,800 ED µg/L), the presence of contamination in the bedrock is unknown. Due to space limitations for access for a large drilling rig, no additional monitoring wells are recommended.

- Data Gap #3 (zone in unstable bedrock): Because of the unstable nature of the upper bedrock, there is a data gap zone between the shallow well screens and the shallowest ports in the bedrock monitoring wells. This data gap zone ranges from 32 to 70 feet in thickness in paired wells across the Site and required double and triple steel casings during drilling of the bedrock boreholes. No samples (soil or groundwater) were collected during drilling and casing installation of the monitoring wells. The presence of chlorinated VOCs in this unstable bedrock zone is unknown. The following OU-2 monitoring wells will address this data gap.
    - Four additional monitoring wells in the unstable bedrock (with screens near the top of the data gap zone since this upper zone is the most likely to be contaminated due to the high levels of contamination in the saprolite wells in many locations)
        - *At MW3-S/MPW-3 – Single screen unstable bedrock zone well (approximate depth/well screen: 60 feet bgs/45-55 feet bgs) (data gap zone between existing wells is 52 feet – between 42 to 94 feet bgs)*
        - *At MW-4S/MPW-4 location – Single screen unstable bedrock zone well (approximate depth/well screen: 50 feet bgs/35-45 feet bgs) (data gap zone between existing wells is 70 feet – between 28 to 98 feet).*
        - *Between MW-6S and MW-7S – Single screen unstable bedrock zone well (estimated depth/well screen: 70 feet bgs/55-65 feet bgs) (data gap zone in this area is about 40 feet - between 52 to 91 feet bgs)*
        - *At northern end of the park in the Santa Marta neighborhood – Single screen unstable bedrock zone well (estimated depth/well screen: 60 feet bgs/45-55 feet bgs)*
- Data Gap #4 (preferential flow pathways): There may be preferential flow pathways between the shallow saprolite where the highest contamination has been identified and the underlying bedrock. Since some of the bedrock wells completed with multiple monitoring ports are not contaminated with PCE or TCE from the overlying contaminated shallow zone, preferential flow paths connecting the two zones may not always be present to allow migration of contaminants downward into the bedrock. No additional wells are recommended specifically to fill this data gap. Data from the OU-2 additional monitoring wells will be evaluated to minimize this data gap.
- Data Gap #5 (extent of groundwater plumes): The full extent of groundwater contamination is unknown in several areas of the Site including: 1) in the area north/northeast of the source areas at Retiro Industrial Park; 2) in the northern part of the residential area and along the Río Guanajibo; and 3) downgradient of MW-10S and the groundwater screening transect T10, toward the three supply wells. The following OU-2 monitoring wells will address this data gap in the Site areas specified.

    - Area 1 – One additional well: Shallow saprolite well coupled with the DNAPL bedrock well in Data Gap #1 – single screen saprolite well (approximate depth/well screen: 30 feet bgs/15-25 feet bgs)

    - Area 2 – Three additional wells: 1) Near groundwater transect location T4-0 with TCE (335D µg/L)/PCE (3,730D µg/L) – single screen saprolite well (approximate depth/well screen: 35 feet bgs/20-30 feet bgs), 2) Near groundwater transect location T8-00 (near surface water location with low level of PCE) – single screen saprolite well (approximate depth/well screen: 30 feet bgs/15-25 feet bgs), 3) At the northern end of the park in the Santa Marta neighborhood – single screen saprolite well (estimated depth/well screen: 40 feet bgs/25-35 feet bgs)

    - Area 3 – One additional well: Downgradient of Lola I supply well and MW-10 well cluster – single screen saprolite monitoring well (approximate depth/screen interval: 55 feet bgs/40-50 feet bgs)

- Data Gap #6 (groundwater flow direction): The alignment of Site monitoring wells (in a straight line) makes it difficult to determine the current direction of groundwater flow (toward the northwest and the former supply wells or toward the north and the Río Guanajibo). The additional monitoring wells described above will help to resolve the current groundwater flow direction (north or northwest), which has been difficult to discern because of the relatively straight alignment of the original monitoring wells.

- OU-2 sampling of all monitoring wells/ports after additional wells are installed should include trace level Target Compound List (TCL) VOCs and all monitored natural attenuation parameters.

- OU-2 hydrogeological investigations should include slug testing in a selected number of saprolite wells (existing and new) and at new unstable bedrock wells. Slug test results will provide data regarding hydraulic conductivity and will be useful to the engineers conducting the FS for OU-2.

Section 2

Work Plan Approach

2.1 Project Organization

The project organization is shown in Figure 2-1.

2.2 Technical Document Development

To develop the technical documents for the Site, CDM Smith utilized existing information developed during the RI/FS for OU-1. The investigations and sequence of implementation proposed in this work plan were developed by CDM Smith and presented to EPA in a technical meeting on October 8, 2015. Comments provided by EPA at the meeting have been incorporated into this document.

2.3 Quality Assurance

All CDM Smith work on this work assignment will be performed in accordance with the CDM Smith RAC2 Quality Management Plan (QMP) (CDM Smith 2012).

The RAC2 quality assurance specialist (QAS) will maintain quality assurance (QA) oversight for the duration of the work assignment. A CDM Smith QAS has reviewed this work plan for QA requirements. CDM Smith will prepare an addendum to the Final Quality Assurance Project Plan (QAPP) for OU-1 (CDM Smith 2011) that will include descriptions of each additional monitoring well, updated installation procedures, analytical requirements, and a figure that shows the proposed well locations.

The CDM Smith site manager (SM) is responsible for implementing appropriate quality control (QC) measures on this work assignment. Such QC responsibilities include:

- Implementing the QC requirements referenced or defined in this work plan
- Adhering to the CDM Smith RAC Management Information System (RACMIS) document control system
- Organizing and maintaining work assignment files
- Conducting planning meetings, as needed, in accordance with the RAC2 QMP

Technical and QA review requirements as stated in the QMP will be followed on this work assignment.

Document control aspects of the program pertain to controlling and filing documents. CDM Smith has developed a program filing system that conforms to EPA's requirements to ensure that the documents are properly stored and filed. This system will be implemented to control and file all documents associated with this work assignment. The system includes document receipt control procedures, a file review, an inspection system, and file security measures.

The RAC2 QA program includes self-assessments as checks on the quality of data generated on this work assessment. Self-assessments include project self-assessment, calculation checking, and data validation; independent reviews include performance audits, and QA and technical reviews.

2.4 Project Schedule

A project schedule for this work plan is included as Figure 2-2. The proposed project schedule is based on assumptions for durations and conditions of key events occurring on the critical and non-critical paths. The project schedule assumes a timely review and approval of the work plan and other documents and the provision of adequate funding by EPA.

2.5 General Requirements

General requirements include those relating to sustainable (or green) remediation, project data management, and record-keeping, as described in the following sections.

2.5.1 Sustainable Remediation/Green Remediation

Green remediation is the practice of considering all environmental effects of the implementation of a remedy and incorporating options to maximize the net environmental benefit of cleanup actions. In accordance with EPA's strategic plan for compliance and environmental stewardship, EPA strives for cleanup programs that use natural resources and energy efficiently, reduce negative impacts on the environment, minimize or eliminate pollution at its source, and reduce waste to the maximum extent possible.

The EPA Region 2 Superfund program supports the adoption of "green site assessment and remediation," which is defined as the practice of considering all environmental impacts of studies, selecting and implementing a given remedy, and incorporating strategies to maximize the net environmental benefit of cleanup actions (see http://www.clu-in.org/greenremediation).

On March 17, 2009, Region 2 established a "Clean & Green" policy to enhance the environmental benefits of Superfund cleanups by promoting technologies and practices that are sustainable. This policy applies to all Superfund cleanup projects, and is available at http://www.epa.gov/region02/superfund/green_remediation/policy.html. Under EPA's policy, certain green remediation technologies will serve as touchstones for Region 2 response actions. The Region 2 "touchstone technologies" include the following examples.

- Use of 100 percent of electricity from renewable sources http://www.epa.gov/osw/partnerships/c2p2/index.htm
- Concrete made with Coal Combustion Products replacing a portion of traditional cement
- Clean diesel fuels and technologies http://www.epa.gov/lmop/overview.htm - methane
- Methane capture at landfill sites http://apps3.eere.energy.gov/greenpower/buying/buying_power.shtml and http://www.epa.gov/oms/retrofit/nonroad-list.htm

Green remediation objectives will be implemented by planning field activities that minimize fuel usage and impact to the environment. Planning that can minimize environmental impact includes measures that:

- Minimize the number of field mobilizations
- Use of ultra-low sulfur diesel or fuel-grade biodiesel as fuel, if available (e.g., drilling equipment)
- Use of non-phosphate detergents for decontamination
- Schedule sampling to minimize shipping
- Use of in-situ treatment and natural degradation processes to minimize energy usage and generation of greenhouse gases

To the extent practicable, CDM Smith will explore and implement green remediation strategies and applications in the performance of the requirements of this work assignment to maximize sustainability, reduce energy and water usage, promote carbon neutrality, promote industrial materials reuse and recycling, and protect and preserve land resources. CDM Smith will maintain records of "green-related" activities, and report this information to EPA in its monthly progress reports or as requested by the Project Officer (PO).

The following guidance documents provide additional information regarding the implementation of "Green Remediation" practices.

- EPA's "Green Remediation Practices" attachment to the Statement of Work (SOW) for this Work Assignment
- Federal Acquisition Regulation, Part 23, "Environment, Energy and Water Efficiency, Renewable Energy Technologies, Occupational Safety, and Drug-Free Workplace:" Federal Acquisition Regulation (FAR) Subparts 23.2, 23.4, 23.7, and 23.8 (see http://www.arnet.gov/far/05-23-1/html/FARTOCP23.html)
- Executive Order 13423, "Strengthening Federal Environmental, Energy, and Transportation Management" (January 2007) (http://www.epa.gov/oaintrnt/practices/eo13423.htm)

2.5.2 Project Data Management and Electronic Data Deliverable Requirements

The goals of project data management are to store and manage the data generated during the project so it is ready and available for analysis and reporting. The Environmental Quality Information Systems (EQuIS) will be used as the Site database. EPA's standardized electronic data deliverable (EDD) format will be utilized in order to streamline the electronic submittal of all environmental data. CDM Smith will provide all field sampling and laboratory analytical results, geological data, and well location data in EPA Region 2's required EDD format. Requirements are contained within EPA Region 2's "Comprehensive Electronic Data Deliverable Specification Manual 3.0" (2015a). Additional EPA Region 2 EDD guidance and requirement documents, including the "Electronic Data Deliverables Valid Values Reference Manual" (2015b), and the

"Electronic Data Deliverable Basic Manual for Historic Electronic Data" (Version 4.0) (EPA 2015c).

2.5.3 Record-Keeping Requirements

CDM Smith will maintain all technical and financial records for this work assignment in accordance with the requirements of the SOW and the technical direction of the EPA remedial project manager (RPM). These technical and financial records will be in sufficient detail to support decisions made during this RI/FS for OU-2. At the completion of the work assignment, CDM Smith will submit three bound copies of the official record of the work and one copy of the major deliverables in electronic format to the EPA RPM, with one copy to the EPA Records Manager.

Section 3

Task Plans

The tasks identified in this section correspond to EPA's SOW for the site, dated March 2, 2016. The tasks for the OU-2 RI/FS presented below correspond to the applicable tasks presented in the *Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988). In addition, EPA's SOW includes a task for project close-out. The task presentation order and numbering sequence correspond to the work breakdown structure provided in EPA's SOW. Only tasks and subtasks with work specified in the SOW are presented below.

3.1 Task 1 – Project Planning and Support

The project planning task generally involves several subtasks that must be performed in order to develop the plans and the corresponding schedule necessary to execute the RI/FS. These subtasks include project administration, preparing the Draft and Final RI/FS work plans, revisions to the OU-1 QAPP and health and safety plan (HASP), procurement and management of subcontractors, and attending technical meetings with EPA and other support agencies.

3.1.1 Project Administration

The project administration activity involves regular duties performed by the CDM Smith SM and the program support personnel throughout the duration of this work assignment. CDM Smith will provide the project administration support listed below.

The SM will:

- Prepare the technical monthly report
- Review weekly financial reports
- Review and update the project schedule
- Attend quarterly internal RAC 2 meetings
- Communicate regularly with the EPA RPM
- Prepare staffing plans

The program support personnel will:

- Review the work assignment technical and financial status
- Review the monthly progress report
- Provide technical resource management
- Review the work assignment budget

- Respond to questions from the EPA PO and Contracting Officer (CO)
- Prepare and submit invoices

3.1.2 Scoping Meeting

Per direction from EPA, this subtask is not applicable.

3.1.3 Conduct Site Visit

Per direction from EPA, this Subtask is not applicable.

3.1.4 Prepare Draft Work Plan and Associated Cost Estimate

CDM Smith has prepared this RI/FS work plan in accordance with the contract terms and conditions, utilizing existing and current site data and information, information from EPA guidance documents (as appropriate) and technical direction provided by the EPA RPM.

This work plan includes a comprehensive description of project tasks, the procedures to accomplish them, project documentation, and a project schedule. CDM Smith uses internal QA systems and QC procedures to insure that the work plan and other deliverables are of professional quality requiring only minor revisions (to the extent that the scope is defined and is not modified). The work plan includes the information specified below.

- Identification of RI project elements including planning and conducting field activities, data evaluation and management, and report preparation. The detailed work breakdown structure of the RI/FS corresponds to the work breakdown structure provided in the EPA SOW (dated March 2, 2016) and discussions with EPA.
- CDM Smith's technical approach for each task to be performed, including a detailed description of each task, assumptions, information to be produced during and at the conclusion of each task, and a description of the work products that will be submitted to EPA. Issues relating to management responsibilities and contingency procedures are also addressed.
- A schedule with dates for completion of each required activity, critical path milestones and submission of each deliverable required by the SOW and the anticipated review time for EPA.
- A project organization chart (Figure 2-1) for the work assignment.

CDM Smith's draft work plan budget (Volume 2 of the RI/FS work plan) follows the work breakdown structure in the SOW. The draft work plan budget contains a detailed cost breakdown by subtask of the direct labor costs, other direct costs (ODCs), projected fee, and any other specific cost elements required to perform each of the subtasks included in the SOW. ODCs are broken down into individual cost categories as required for this work assignment, based on the specific cost categories negotiated under CDM Smith's contract. A detailed rationale describing the assumptions for estimating the professional level of effort (PLOE), professional and technical levels and skills mix, and ODCs are provided for each subtask in the SOW.

3.1.5 Negotiate and Prepare Final Work Plan and Budget

CDM Smith personnel will attend a work plan negotiation meeting with EPA to discuss and agree upon the final technical approach and costs required to accomplish the tasks detailed in the work plan. CDM Smith will submit a final work plan incorporating EPA comments and a negotiated work plan budget incorporating the agreements made in the negotiation meeting. The negotiated work plan budget will include a summary of the negotiations. CDM Smith will submit the final work plan and negotiated work plan budget in both hard copy and electronic formats.

3.1.6 Evaluate Existing Data and Documents

Per direction from EPA, this subtask is not applicable.

3.1.7 Quality Assurance Project Plan

CDM Smith will revise and update the QAPP prepared for OU-1 under work assignment 039-RICO-02YP. The QAPP Addendum will be prepared in accordance with the *EPA Requirements for Quality Assurance Project Plans* (EPA 2006), the *Uniform Federal Policy (UFP) for Quality Assurance Project Plans* (EPA 2005a), current EPA Region 2 RAC QAPP guidance and procedures, and CDM Smith's approved Quality Management Plan (CDM Smith 2012) for the RAC 2 contract. CDM Smith will use pertinent documents and information from the OU-1 work assignment in preparing the addendum, which will be submitted separately from this work plan.

The QAPP is a comprehensive document that describes the project objectives and organization, functional activities, and QA/QC protocols that will be used to achieve the desired Data Quality Objectives (DQOs). The DQOs will, at a minimum, reflect use of analytical methods for identifying and addressing contamination consistent with the levels for remedial action objectives identified in the National Contingency Plan (NCP).

The QAPP Addendum will describe the number, type, and location of samples and type of analyses to be performed. It will include sampling objectives, sample locations and frequency, sampling equipment and procedures, sample handling and analysis, and a breakdown of samples to be analyzed through the Contract Laboratory Program (CLP) and other sources, as well as the rationale for the field program design. The QAPP Addendum will use all existing data and the need for additional data will be justified. It will be written so that a field sampling team unfamiliar with the Site would be able to gather the necessary samples and field information in accordance with EPA Region 2's QA requirements. CDM Smith will document changes to the QAPP Addendum in a field change notification (FCN) form to the EPA RPM and QA Officer.

3.1.8 Health and Safety Plan

CDM Smith will use the site-specific HASP prepared under OU-1 Work Assignment 039-RICO-02YP during field investigations for this RI/FS.

3.1.9 Non-RAS Analysis - Optional

At the direction of EPA, CDM Smith will develop an EPA-approved laboratory QA program that provides oversight of in-house and subcontracted laboratories through periodic performance evaluation sample analyses and/or on-site audits of operations, and prescribes a system of corrective actions to be implemented in cases where the laboratory's performance does not meet the standards of this program. The minimum requirements are specified below.

- Prepare Laboratory Services Requests (including statements of work) for all non-routine analytical service (Non-RAS) parameters. The Laboratory Services Requests will include the elements listed below.
  - digestion/analytical methods
  - data deliverable requirements
  - QC requirements
  - estimated number of samples
  - method restrictions and penalties for non-compliance
  - turnaround times
- Develop QC criteria for each parameter of the approved site-specific or contract-wide QAPP that will be incorporated into the Laboratory Service Request.
- Comply with all applicable and appropriate requirements in the acquisition and management of subcontracts for analytical services, including the requirements, terms, and conditions of this contract; the subcontractor's corporate standard operating procedures; and the applicable requirements of the FAR, Environmental Protection Agency Acquisition Regulation (EPAAR), and other pertinent Federal and Agency acquisition requirements.
- At the request of the EPA RPM, submit the Laboratory Services Requests for EPA review prior to solicitation of an analytical services subcontract.

3.1.10 Meetings

CDM Smith will participate in various meetings with EPA during the course of the work assignment. CDM Smith will prepare minutes which list the attendees and summarize the discussions in each meeting.

3.1.11 Subcontract Procurement

CDM Smith will solicit and award subcontracts that are necessary to perform the field investigations for the Site, expected to include procurement of a driller, surveyor, and investigation derived waste (IDW) specialist. The statements of work for all subcontracts will be subject to CDM Smith technical and QA reviews.

3.1.12 Perform Subcontract Management

CDM Smith will perform management and oversight of all subcontracts needed for RI/FS activities, including monitoring progress and maintaining systems and records to ensure that the work proceeds in accordance with the requirements of this work assignment and the RAC 2 contract. CDM Smith will review and approve subcontractor invoices and issue subcontract modifications that become necessary during the course of the work.

3.1.13 Pathway Analysis Report

Per direction from EPA, this subtask is not applicable.

3.2 Task 2 - Community Involvement

This task covers technical support to be provided during public meetings and availability sessions. CDM Smith will provide community involvement support to EPA throughout the RI/FS in accordance with the "Superfund Community Involvement Handbook" (EPA 2005b).

3.2.1 Community Interviews

Per direction from EPA, this subtask is not applicable.

3.2.2 Community Involvement Plan

Per direction from EPA, this subtask is not applicable.

3.2.3 Public Meeting Support

CDM Smith will perform the activities described below to support one public meeting and one availability session during the RI/FS.

- CDM Smith will make reservations for a meeting space, per the technical direction of the EPA RPM.
- CDM Smith will attend one public meeting and one availability session, and prepare meeting summaries.
- CDM Smith will prepare draft visual aids in PowerPoint, as directed by the EPA RPM; 35 slides and 60 handouts are assumed to be required for each public meeting. CDM Smith will prepare the handouts in English and Spanish. Final visual aids will incorporate all EPA comments.
- CDM Smith will reserve a court reporter for the public meeting, as directed by the EPA RPM, and provide a full-page original and a "four on one" page copy, along with an electronic version of the transcripts, with additional copies placed in the information repositories as required by the RPM.
- CDM Smith will prepare and maintain a sign-in sheet for the public meeting.

3.2.4 Fact Sheet Preparation

CDM Smith will prepare draft information letters, updates, and fact sheets for the public meetings and availability session, as directed by the EPA RPM. It is assumed that two fact sheets will be prepared (one fact sheet for the public meeting and one for the availability session); each fact sheet will be three to five pages in length with four illustrations. Fact sheets will be researched, written, edited, designed, laid out, and photocopied; they will be written in both English and Spanish. CDM Smith will attach mailing labels to the fact sheets before delivering them to EPA for mailing. CDM Smith will provide copies of each fact sheet to EPA. Final fact sheets will reflect EPA's comments.

3.2.5 Proposed Plan Support

Per direction from EPA, this subtask is not applicable.

3.2.6 Public Notices

CDM Smith will prepare newspaper announcements/public notices for the public meeting and availability session, for inclusion in the most widely read local newspapers, with each ad placed in one large, area-wide newspapers and one small town local newspaper. Public announcements/ notices will be prepared in both English and Spanish.

3.2.7 Information Repositories

Per direction from EPA, this subtask is not applicable.

3.2.8 Site Mailing List

Per direction from EPA, this subtask is not applicable.

3.2.9 Responsiveness Summary Support

CDM Smith will provide administrative and technical support for the Site Responsiveness Summary. The draft document will be prepared by compiling and summarizing the public comments received during the public comment period on the Proposed Plan. CDM Smith will prepare technical responses for selected public comments, for EPA review and use in preparing formal responses. CDM Smith assumes receipt of 60 separate comments.

3.3 Task 3 - Field Investigation

Data acquisition covers the collection of environmental samples and information required to support the OU-2 RI/FS. Data acquisition begins with EPA's approval of the modifications to the OU-1 QAPP and ends with the demobilization of field personnel and equipment from the Site. CDM Smith will perform the following field activities in accordance with the EPA-approved QAPP modifications.

- Assess condition of existing OU-1 monitoring wells (Section 3.3.3)
- Install monitoring wells and temporary piezometers (Section 3.3.3)
- Conduct hydraulic conductivity testing (Section 3.3.3)
- Measure synoptic water levels (Section 3.3.3)
- Collect Round 1 monitoring well samples (Section 3.3.5)
- Collect pore water samples (Section 3.3.5)
- Collect surface water samples (Section 3.3.5)
- Collect Round 2 monitoring well samples (Section 3.3.5)
- Sample and dispose of IDW (Section 3.3.8)

3.3.1 Site Reconnaissance

CDM Smith will perform monitoring well and piezometer location reconnaissance and surveyor oversight. Photographic documentation of Site conditions will be maintained. CDM Smith assumes the existing monitoring wells will not need redevelopment.

CDM Smith will submit a monthly field activity report to the EPA RPM by electronic mail and in hardcopy.

3.3.2 Mobilization and Demobilization

CDM Smith will mobilize personnel, equipment, and materials necessary to perform the field investigation. CDM Smith assumes one mobilization event will be necessary to complete the OU-2 field investigation. Mobilization activities will include a field planning meeting, a health and safety briefing for project team members, siting and electrical hookup of a field trailer, and purchase and mobilization of equipment and supplies.

Demobilization activities will include removal of all equipment and facilities brought to the Site by CDM Smith and site restoration.

Site Access Support

Access to new monitoring well locations will be needed to execute the field investigation. EPA will be responsible for obtaining property access. CDM Smith will assist EPA with Site access by providing a list of property owners (public and private) to be accessed during the field activities. The list will include mailing addresses and telephone numbers of the property owners. Once EPA has established that access has been granted, field activities can begin. CDM Smith will contact and coordinate with property owners, local officials, and appropriate government agencies to schedule activities.

3.3.3 Hydrogeological Assessment

CDM Smith will perform the following activities under this subtask to assess the hydrogeological conditions at the Site and to fill the data gaps identified during the OU-1 investigations.

- Assess condition of existing OU-1 monitoring wells
- Install monitoring wells and temporary piezometers
- Conduct hydraulic conductivity testing
- Measure synoptic water levels

Assess Condition of Existing OU-1 Monitoring Wells

CDM Smith will assess the condition of all monitoring wells installed during the OU-1 field investigations to confirm that their condition remains unchanged from the last sampling conducted in January 2014. CDM Smith will observe and note the exterior condition of each well, open the well cap, and measure the depth to water. It is assumed that the wells will not need re-development.

Install Monitoring Wells and Temporary Piezometers

A total of 10 monitoring wells will be installed, as summarized on Table 3-1; 5 wells will be screened in saprolite, 4 wells in unstable bedrock, and 1 well in bedrock. Five temporary piezometers will be installed at the edge of the Río Guanajibo. Locations are shown in Figure 3-1. The final locations of all OU-2 monitoring wells will be determined in the field.

<u>Saprolite Monitoring Wells</u>

At each saprolite well location, a temporary casing will be installed in the upper zone to prevent borehole collapse. Upon installation of the temporary casing, a borehole will be advanced to depth utilizing air rotary drilling. Saprolite wells will be completed with 4-inch diameter Schedule 40 polyvinyl chloride (PVC) casing with 10 feet of slotted screen.

<u>Unstable Bedrock Monitoring Wells</u>

Because of the unstable nature of the data gap zone in the upper portion of the bedrock, CDM Smith recommends that the rotary drilling method be used inside a temporary casing to assist with stabilizing the key portions of the borehole and preventing collapse. The drilling and well completion process will have to be completed very rapidly because of the unstable nature of this zone. Therefore, CDM Smith recommends that the unstable bedrock wells will be completed within the temporary casing utilizing 2-inch diameter prepacked PVC well screens and 2-inch diameter PVC casing prior to removal of the temporary casing.

Prepacked screens consist of a standard, slotted PVC well screen pipe surrounded by a stainless steel mesh. Sand is packed between the slotted PVC and the stainless steel mesh. Since the sand is packed around the slotted PVC before the well screen is installed, using prepacks guarantees that sand will be located directly around the well screen.

<u>Bedrock Monitoring Well</u>

Air rotary drilling will be used to advance the bedrock monitoring well borehole to the selected depth. A borehole will be drilled and carbon steel casing will be sealed into the top of the bedrock. If the unstable bedrock zone is problematic during drilling, an additional casing will be installed to insure that the well can be completed at the desired depth. If triple casing is required, each casing diameter cited above will be increased by two inches. During OU-1 drilling in the bedrock, five boreholes required double casing, one required triple casing, and one required single casing. The stable bedrock portion of the borehole (below the casings) will be completed with 4-inch diameter Schedule 80 PVC screen and casing. The slotted screen will be 10 feet in length.

All new monitoring wells will be completed at the ground surface with a 3-foot high, 4-inch diameter stick-up with cap and lock. A six-inch square steel well cover will be installed, and a 4 feet by 8 feet, 6-inch thick concrete pad will be cast in place. Four steel bollards will be installed around each well for protection against traffic.

<u>Temporary Piezometers</u>

Five temporary piezometers will be installed at the edge of the Río Guanajibo in order to confirm the interaction between the groundwater and surface water that was observed during OU-1 investigations. Pore water samples will also be collected from the piezometers, as described in Section 3.3.5. A pipe and screen assembly will be driven into the Río Guanajibo streambed so the screen completely penetrates the sediments and is not visible at the streambed surface. The piezometers will be removed after Round 1 water levels are measured and pore water samples are collected.

Well Development

Each monitoring well will be fully developed to remove drilling fluids, silts, and well construction materials from the screen and sand pack and to provide a good hydraulic connection between the well and the aquifer materials. Turbidity, pH, temperature, conductivity, and dissolved oxygen will be monitored during development until all parameters stabilized (within 10 percent for successive measurements), the water is clear, and there is good hydraulic connection between the well and the aquifer.

Location Measurement

The locations and elevations of new monitoring wells and temporary piezometers will be surveyed by a professional land surveyor under subcontract to CDM Smith. It is assumed that 10 monitoring wells and 5 piezometers will be surveyed (easting/northing) for locations and elevations of the land surface, protective pad, top of the outer protective casing and the top of the inner PVC casing.

Conduct Hydraulic Conductivity Testing

Aquifer slug tests will be conducted at selected OU-1 and OU-2 monitoring wells to estimate aquifer properties. Slug tests are a rapid and easy means to estimate transmissivity of an aquifer. Advantages of slug tests over pump tests include the fact that little or no contaminated water is produced, which then requires containment, sampling, and disposal as IDW or treatment prior to disposal. Disadvantages include the limitation of transmissivity estimates to a small volume of the aquifer around the borehole and extrapolating the results from one well to other areas or intervals of the aquifer may be questionable.

Slug tests are conducted by adding (or removing/displacing) a known volume to (or from) the monitoring well to create a rapid rise (or fall) in water level. Water levels are measured as the water in the well returns to static (pre-test) conditions. Water is displaced with a weighted cylinder of known volume. The rate of water recovery is measured with a pressure transducer and data recorder. Both rising and falling head slug tests will be conducted. Slug test procedures will be fully detailed in the QAPP Addendum.

CDM Smith recommends that slug tests be conducted in the OU-1 and OU-2 monitoring wells listed below; the locations were selected to be representative of the lithologies observed throughout the Site.

- Saprolite wells: MW-2S, MW-3S, MW-10S, and MW-15S
- Unstable bedrock wells: MW-3UR, MW-4UR, MW-14UR
- Bedrock: MW-12R

Measure Synoptic Water Levels

CDM Smith will collect two rounds of synoptic water level elevation measurements prior to each round of sampling to better define groundwater flow in the vicinity of the Site. The temporary piezometers will be included in the Round 1 measurements.

3.3.4 Soil Boring, Drilling, and Testing

The additional field investigations to fill data gaps identified during OU-1 are presented in Sections 3.3.3 and 3.3.5.

3.3.5 Environmental Sampling

CDM Smith will perform the activities listed below under this subtask. Table 3-2 summarizes the number of samples and associated analytical parameters for the environmental media that will be sampled. Sampling locations are shown on Figure 3-1.

- Round 1 monitoring well sampling
- Pore water sampling
- Surface water sampling
- Round 2 monitoring well sampling

Round 1 Monitoring Well Sampling

Groundwater samples will be collected at all OU-1 and OU-2 monitoring wells, including 14 wells screened in the saprolite, 4 wells screened in the unstable bedrock, 2 single screen bedrock monitoring wells, and 7 multiport monitoring wells with 25 ports (45 samples). The low-flow sampling methodology will be used except for the multiport wells, which will be sampled per the methodology for FLUTe wells. Analyses will include trace-level TCL VOCs with selective ion monitoring (SIM) analysis for vinyl chloride. To support evaluation of monitored natural attenuation (MNA) of VOCs in groundwater, samples from each monitoring well/port will be analyzed for the following parameters: chloride, methane/ethane/ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, and total organic carbon (TOC). These samples will also analyzed for water quality parameters including total suspended solids (TSS), total dissolved solids (TDS), alkalinity, ammonia, hardness, and total Kjeldahl nitrogen (TKN). Dissolved oxygen, oxidation-reduction potential (as Eh), turbidity, temperature, ferrous iron, and conductivity will be measured in the field. A flow-through cell will be used when measuring oxygen-sensitive field parameters. CDM Smith assumes that the TCL parameters will be analyzed through EPA's CLP and that EPA's Division of Environmental Science and Assessment (DESA) laboratory will analyze the MNA and water quality parameters.

Pore Water Sampling

Simultaneously with the Round 1 monitoring well sampling, grab samples will be collected from the five temporary piezometers installed within the Río Guanajibo. Samples will be analyzed for trace-level TCL VOCs with SIM analysis for vinyl chloride through the CLP.

Surface Water Sampling

Simultaneously with the Round 1 monitoring well sampling, surface water samples will be collected from the Río Guanajibo to confirm the interaction between surface water and groundwater and the discharge of the groundwater plume to the surface water. It is assumed that five surface water samples will be collected in areas of the river that are in potential groundwater discharge locations. Samples will be analyzed for trace-level TCL VOCs with SIM analysis for vinyl chloride through the CLP.

Round 2 Monitoring Well Sampling

CDM Smith will discuss the Round 1 sampling results with EPA and determine the appropriate subset of monitoring wells/ports that should be sampled during Round 2. Samples will be analyzed for the same parameters as Round 1. CDM Smith assumes that 25 environmental samples will be collected.

3.3.6 Ecological Characterization

Per direction from EPA, this subtask is not applicable.

3.3.7 Geotechnical Survey

Per direction from EPA, this subtask is not applicable.

3.3.8 Investigation - Derived Waste Characterization and Disposal

CDM Smith will characterize and dispose of IDW in accordance with local, Commonwealth, and Federal regulations as specified in the QAPP Addendum and the *Guide to Management of Investigation-Derived Wastes* (EPA 1992a).

3.4 Task 4 - Sample Analysis

CDM Smith will arrange for the analysis of environmental samples collected under Task 3, as specified in Sections 3.3.5. Table 3-2 summarizes the field sampling program and analyses for each sample.

3.4.1 Innovative Methods/Field Screening Sample Analysis

Per direction from EPA, this subtask is not applicable.

3.4.2 Analytical Services Provided via CLP, DESA or EPA-ERT

CDM Smith will request analytical services for the samples listed below. Analysis of these samples will be performed by Region 2 DESA or CLP.

Groundwater

- Round 1 monitoring well samples – 45 samples analyzed for trace-level TCL VOCs and SIM for vinyl chloride; MNA parameters: chloride, methane/ethane/ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, TOC; water quality parameters: TSS, TDS, alkalinity, ammonia, hardness, TKN

- Round 2 monitoring well samples – List of wells/ports to be discussed with EPA; assume 25 samples analyzed for trace-level TCL VOCs and SIM for vinyl chloride; MNA parameters:

chloride, methane/ethane/ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, TOC; water quality parameters: TSS, TDS, alkalinity, ammonia, hardness, TKN

Pore Water

- Temporary piezometers – 5 samples analyzed for trace-level TCL VOCs and SIM for vinyl chloride

Surface Water

- 5 samples analyzed for trace-level TCL VOCs and SIM for vinyl chloride

3.4.3 Non-Routine Analytical Services

CDM Smith will follow the Field and Analytical Services Teaming Advisory Committee (FASTAC) policy for procuring laboratory services. CDM Smith assumes the MNA and water quality samples will be analyzed by DESA and a subcontract laboratory will not be required.

3.5 Task 5 - Analytical Support and Data Validation

CDM Smith will ensure that all subcontracted laboratory analyses are performed in accordance with generally-accepted EPA methods, and all analytical data from subcontract laboratories will be submitted to EPA in a CLP-deliverable format.

3.5.1 Prepare and Ship Samples

CDM Smith will prepare and ship the analytical samples collected under Task 3 in accordance with the approved QAPP.

3.5.2 Sample Management

CDM Smith will perform sample management for the activities described below. Sample management will be coordinated by the Analytical Services Coordinator (ASC).

- Coordinate with the EPA Sample Management Office (SMO), the Region 2 Sample Control Coordinator (RSCC), DESA and other applicable EPA sample management offices regarding analytical, data validation, and QA issues.

- Implement the EPA-approved laboratory QA program to provide oversight of in-house and subcontract laboratories. (This activity will be performed only if Subtask 3.1.9 is performed under this work assignment.)

- Provide chain-of-custody, sample retention, and data storage functions in accordance with the approved QAPP, QMP, and RAC 2 contract requirements. CDM Smith will ensure that accurate chain-of-custody procedures are implemented and carried out for sample tracking, protective sample packing is performed, and proper sample preservation techniques are used.

3.5.3 Data Validation

CDM Smith will validate any non-RAS sample data generated by a subcontract laboratory to ensure that the data and documentation such as the chain-of-custody are accurate and defensible, as summarized below.

- Review analysis results against validation criteria
- Review the data and make a data usability determination
- Provide a data validation report to the EPA RPM after all data have been validated

No non-RAS sample data from subcontract laboratories are currently anticipated for OU-2.

3.6 Task 6 - Data Evaluation

This task includes efforts related to the compilation of analytical and field data. All validated data generated during this RI will be entered into the existing Site EQuIS database to meet EPA Region 2 EDD requirements. Tables, figures, and maps will be generated from the data to support preparation of the RI report, the HHRA report, and the FS report. The data will be reviewed and carefully evaluated to identify the nature and extent of site-related contamination.

3.6.1 Data Usability Evaluation

CDM Smith will evaluate the usability of the data, including any uncertainties associated with the data. The data validation reports will be reviewed and field sampling techniques, results of self or independent assessments, laboratory analytical methods and techniques, and data quality objectives will all be considered in evaluating the usability of the data. The usability of the data will be evaluated using the DQOs defined in the QAPP. Any rejected data will be discussed in the data evaluation meeting. Rejected data will be evaluated to determine if it can be used.

3.6.2 Data Reduction, Tabulation, and Evaluation

This subtask will include reduction, tabulation, and evaluation of the data collected during the RI field activities. This subtask includes the activities described below.

Database Management

Data will be stored in EQuIS and can be exported as required to support the analysis and presentation of data using gINT, Microsoft Excel, ArcMAP, graphic software, AutoCAD, Surfer, and other applications. Database management activities, including upload of field sample information, will be performed for the samples to be collected during the RI field program (including field quality control samples), as summarized below.

<u>Groundwater Samples (Rounds 1 and 2)</u>

- Trace-level TCL VOCs: 110 samples
- SIM for vinyl chloride: 110 samples
- MNA parameters: chloride, methane/ethane/ethene, nitrate/nitrite, sulfate, sulfide, TOC; water quality parameters: TSS, TDS, alkalinity, ammonia, hardness, TKN: 110 samples (12 parameters)

<u>Pore Water Samples</u>

- Trace-level TCL VOCs: 9 samples

- SIM for vinyl chloride: 9 samples

Surface Water Samples

- Trace-level TCL VOCs: 9 samples
- SIM for vinyl chloride: 9 samples

All data entry will be QC checked. Tables that compare analytical results with both Commonwealth and federal groundwater standards will be prepared and evaluated.

Well Construction Logs

Well construction information will be used with gINT software to prepare well construction diagrams for the Site monitoring wells. At the conclusion of the project, well construction data will be transferred to EQuIS. CDM Smith assumes that 10 monitoring wells will be installed.

Figures

CDM Smith will create a GIS in order to facilitate spatial analysis of the data and to generate figures for the RI, HHRA, and FS reports and for presentations.

Electronic Data Deliverable

CDM Smith will prepare an EDD in accordance with EPA Region 2 EDD requirements. The EDD will include the analytical and geologic data generated during the course of the OU-2 RI.

3.6.3 Modeling - Optional

This subtask is optional. In the event that EPA determines that performance of this subtask is necessary, EPA will issue a work assignment amendment to formally include these requirements into the work assignment.

CDM Smith will evaluate the existing data collected under the field investigation and assess the need for modeling to complete an accurate characterization of the nature, extent, distribution, and movement of Site contamination. This evaluation will cover the historical distribution and movement of Site contamination (forensic modeling) to help identify potential source areas, utilizing the results of the chemical fingerprinting analysis.

CDM Smith will provide a technical memorandum to the EPA RPM summarizing the results of this evaluation and recommendations concerning performance of modeling for this site. Based on its review of this technical memorandum, EPA will determine whether modeling will be conducted for this RI/FS, and will direct CDM Smith to perform a modeling effort, if required.

3.6.4 Data Evaluation Report

CDM Smith will evaluate and present results in a Data Evaluation Summary meeting, to be arranged through the EPA RPM. The meeting will include an evaluation of historical data, identification of gaps that may be addressed as part of the RI, summary of data gathered as part of the field investigation, and identification of data gaps for future investigations. If additional analytical data are needed or if significant data problems are identified, CDM Smith will provide a separate memorandum describing these problems for review by the RPM.

3.7 Task 7 - Assessment of Risk

The risk assessment will determine whether site contaminants pose a current potential risk to human health and the environment in the absence of any remedial action, and will be used to determine whether remediation is necessary at the Site, provide justification for performing a remedial action, and determine which exposure pathways need to be remediated. CDM Smith will perform the risk assessment, addressing the contaminant identification, exposure assessment, toxicity assessment, and risk characterization, in accordance with the requirements of the following subtasks.

3.7.1 Baseline Human Health Risk Assessment

CDM Smith will prepare an addendum to the EPA-approved OU-1 Baseline HHRA (CDM Smith 2015c) prepared under work assignment 039-RICO-02YP to cover the HHRA for OU-2, in accordance with approach and parameters described in the approved Pathways Analysis Report for OU-1 and the requirements of the *Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual* (EPA 2001).

Draft Updated Baseline Human Health Risk Assessment

CDM Smith will prepare a draft Baseline Human Health Risk Assessment report for OU-2, covering the requirements outlined below.

<u>Hazard Identification.</u> CDM Smith will identify and describe the contaminants of potential concern (COPCs) based on their intrinsic toxicological properties.

<u>Dose-Response Assessment.</u> CDM Smith will select the contaminants of concern based on their intrinsic toxicological properties.

<u>Characterization of Site and Potential Receptors.</u> CDM Smith will identify and characterize human populations in the exposure pathways.

<u>Exposure Assessment.</u> The exposure assessment will identify the magnitude of actual or potential human exposures, the frequency and duration of these exposures, and the routes by which receptors are exposed. The exposure assessment will include an evaluation of the likelihood of such exposures occurring and will provide the basis for the development of acceptable exposure levels. In preparing the exposure assessment, CDM Smith will develop reasonable maximum estimates and central tendencies of exposure (when appropriate) for both current and potential land use conditions at the Site. CDM Smith will clearly explain and justify its rationale for use of site-specific over default exposure factors.

<u>Toxicity Assessment.</u> CDM Smith will list all toxicity values (slope factors and reference doses) for the COPCs and the sources of the toxicity values, in accordance with EPA's current toxicity hierarchy (*Human Health Toxicity Values in Superfund Risk Assessments* [EPA 2003]). CDM Smith will submit chemicals without assigned toxicity values in Tiers 1 and 2 to EPA for determination of the appropriate value.

<u>Risk Characterization.</u> During risk characterization, CDM Smith will compare chemical-specific toxicity information, combined with quantitative and qualitative information from the exposure assessment, to measured levels of contaminant exposure and the levels predicted through

environmental fate and transport modeling. These comparisons will determine whether concentrations of contaminants at or near the Site are affecting or could potentially affect human health. Based on these results, CDM Smith will also address other concerns important to the risk characterization, such as a qualitative discussion of chemicals without toxicity data and how concentrations found on Site relate to background concentrations.

Identification of Limitations/Uncertainties. CDM Smith will identify critical assumptions and uncertainties (e.g., background concentrations and conditions, modeling inputs, toxicity data, environmental data, and et al.) in the report.

Site Conceptual Model: CDM Smith will develop a conceptual model of the Site based on the contaminant identification, exposure assessment, toxicity assessment, and risk characterization.

Final Updated Baseline Human Health Risk Assessment Report

CDM Smith will submit the Final Baseline Human Health Risk Assessment Report which incorporates all EPA review comments.

3.7.2 Baseline Screening Level Ecological Risk Assessment

Per direction from EPA, this subtask is not applicable.

3.8 Task 8 - Treatability Study and Pilot Testing (Optional)

Remedial technologies that may be suitable to the Site should be identified as early as possible to determine whether there is a need to conduct treatability studies to better estimate performance capabilities and costs. The treatability study would determine the suitability of remedial technologies to Site conditions and problems. The three levels of treatability studies are: laboratory screening, bench-scale testing, and pilot-scale testing. The laboratory screening is used to establish the validity of a technology to treat waste and is normally conducted during the Feasibility Study. Bench-scale testing is used to identify the performance of the technology specific to a type of waste for an operable unit; bench-scale tests are often conducted during the FS. Pilot-scale testing is used to provide quantitative performance, cost, and design information for remediation, and is typically performed during the RI/FS. EPA's "Guide for Conducting Treatability Studies under CERCLA, Final" (EPA 1992d) will be followed.

3.8.1 Literature Search

CDM Smith will research viable technologies that may be applicable to site-related contaminants and the Site conditions encountered. CDM Smith will provide a technical memorandum to the EPA RPM summarizing the results of the literature research and assessing the need for additional treatability studies. As part of this document, CDM Smith will submit a plan recommending performance of a treatability study at one of the above levels and identifying the types and specific goals of the study. The treatability study will determine the suitability of remedial technologies to Site conditions and problems. Based on its review of this technical memorandum, EPA will determine whether a bench test or pilot study will be conducted for this project, and will direct CDM Smith to prepare an addendum to this RI/FS work plan describing the detailed approach for performance of the treatability study, in accordance with the requirements described in Subtask 3.8.2 below.

3.8.2 Treatability Study Work Plan (Optional)

Upon implementation of this requirement, CDM Smith will prepare an addendum to the RI/FS Work Plans Volume 1 and Volume 2 describing the approach for performance of the treatability study, prepare a final work plan addendum documenting the technical approach approved by EPA, negotiate the additional level of effort and costs required to accomplish the treatability study requirements, and prepare a final budget supplement incorporating the agreements reached during the negotiations.

The treatability study work plan addendum will describe in detail the treatment process and how the proposed technology or vendor (if the technology is proprietary) will meet the performance standards for the Site. The treatability study work plan addendum will address how the proposed technology or vendor of the technology will meet all discharge or disposal requirements for any and all treated material, air, water, and expected effluents. In addition, the work plan addendum will explain the proposed final treatment and disposal of all material generated by the proposed treatment system. The treatability study work plan addendum will describe the technology to be tested, test objectives, test equipment or systems, experimental procedures, treatability conditions to be tested, measurements of performance, analytical methods, data management and analysis, health and safety procedures, and residual waste management. The DQOs for the treatability study will also be documented. If pilot-scale treatability studies are to be done, the treatability study work plan addendum will describe pilot plant installation and startup, pilot plant operation and maintenance procedures, and operating conditions to be tested. If testing is to be performed off-site, the addendum will address permitting requirements. The addendum will include a proposed schedule for performing the treatability study, with specific dates for each task and subtask (including anticipated EPA review periods). Key milestones for which completion dates will be specified include procurement of subcontractors, sample collection, sample analysis and preparation of the treatability study report.

3.8.3 Conduct Treatability Studies (Optional)

CDM Smith will conduct the treatability study in accordance with the approved treatability study addendums to the RI/FS work plan, QAPP, and HASP, to determine whether the remediation technology (or vendor of the technology) can achieve the required performance standards. The activities described below are required as part of the performance of the treatability study and pilot testing.

<u>Procure Test Facility and Equipment</u>. CDM Smith will procure the subcontractors, test facility and equipment necessary to perform the tests.

<u>Test and Operate Equipment</u>. CDM Smith will test the equipment to ensure proper operation, and operate or oversee operation of the equipment during the testing.

<u>Retrieve Samples for Testing</u>. CDM Smith will collect samples for testing as specified in the treatability study work plan addendum.

<u>Perform Laboratory Analysis</u>. CDM Smith will establish a field laboratory to facilitate fast turnaround analysis of test samples, or if necessary, will procure subcontractor laboratory services to analyze the test samples and evaluate test results.

Characterize and dispose of residual wastes. CDM Smith will ensure that residual wastes are characterized and disposed of in accordance with the work plan addendum and QAPP.

3.8.4 Treatability Study Report (Optional)

CDM Smith will prepare a treatability study evaluation report that describes the performance of the technology. The study results will clearly describe the performance of the technology or vendor in comparison with the performance standards established for the site. The report will also evaluate the treatment technology's effectiveness, implementability, cost, and final results as compared with the predicted results. The report will evaluate full-scale application of the technology, including a sensitivity analysis identifying the key parameters affecting full-scale operation.

3.9 Task 9 - Remedial Investigation Report

CDM Smith will develop and submit an addendum to the OU-1 RI report that accurately updates and refines Site characteristics including the delineation of the extent of contamination in Site groundwater and the potential for contamination to reach human or environmental receptors. CDM Smith will evaluate the OU-1 and OU-2 sampling data to confirm the list of site-related contaminants; contaminants will be compared against existing standards and guidelines (e.g., drinking water standards, water quality criteria, and other criteria accepted by EPA). The RI must be consistent with the baseline human health risk assessment.

The OU-2 RI addendum will be prepared in accordance with the *Guidance for Conducting Remedial Investigations/Feasibility Studies under CERCLA* (EPA 1988) and *Guidance for Data Usability in Risk Assessment, Parts A and B* (EPA 1992c).

3.9.1 Draft Remedial Investigation Report

An addendum to the OU-1 Final RI report (CDM Smith 2015a) will be prepared in accordance with the format described in the EPA guidance documents cited above. A draft outline of the addendum is shown in Table 3-3. This outline should be considered draft and subject to revision based on the data obtained. EPA's SOW provides a detailed description of the types of information, maps, and figures to be included in the RI report addendum. CDM Smith will incorporate such information to the fullest extent practicable.

Upon completion, the draft RI report will be submitted to EPA, and other city, commonwealth, and federal agencies, as directed by EPA, for formal review and comment.

3.9.2 Final Remedial Investigation Report

Upon receipt of all EPA and other federal and Commonwealth written comments, CDM Smith will develop responses to significant comments, and finalize the report in accordance to the EPA approved responses prior to submittal.

3.10 Task 10 - Remedial Alternatives Screening

This task covers the development of appropriate remedial alternatives that will undergo full evaluation. The alternatives will encompass a range, including innovative treatment technologies, consistent with the regulations outlined in the NCP, 40 Code of Federal Regulations (CFR) Part

300, the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1998), and other applicable Office of Solid Waste and Emergency Response (OSWER) directives, policies and guidance (including *Considerations in Ground Water Remediation at Superfund Sites* (EPA 1989), and *Considerations in Ground Water Remediation at Superfund Sites - Update* (EPA 1992b).

CDM Smith will develop alternatives that will remediate or control contaminated media related to the Site, as defined in the RI, to provide adequate protection of human health and the environment. The potential alternatives will encompass, as appropriate, a range of alternatives in which treatment is used to reduce the toxicity, mobility, or volume of wastes but vary in the degree to which long-term management of residuals or untreated waste is required. Innovative treatment technologies will be included. One or more alternatives will be included that involve containment with little or no treatment, as well as a no-action alternative.

Based on EPA's *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites. Final Guidance* (EPA 1996), the following alternatives, composed of treatment technologies for potentially affected media at the Site, may be selected as representative technologies in the FS alternatives if they are deemed appropriate.

Groundwater

- No Further Action
- Institutional and Engineering Controls and Monitoring
- Monitored Natural Attenuation
- Groundwater Extraction, Treatment and Discharge
- In situ Anaerobic Biodegradation
- In situ Chemical Reduction

Additional technologies may be evaluated if extremely high levels of contamination are identified.

The alternatives will be screened qualitatively against three criteria: effectiveness, implementability, and relative cost. A brief description of the application of these criteria is presented below.

- Effectiveness - The evaluation focuses on the potential effectiveness of technologies in meeting the remedial action goals; the potential impacts to human health and the environment during construction and implementation; and how proven and reliable the process is with respect to the contaminants and conditions at the Site.
- Implementability - This evaluation encompasses both the technical and administrative feasibility of the technology. It includes an evaluation of treatment requirements, waste management, and relative ease or difficulty in achieving the operation and maintenance requirements. Technologies that are clearly unworkable at the Site are eliminated.

- Relative Cost - Both capital cost and operation and maintenance cost are considered. The cost analysis is based upon engineering judgment, and each technology is evaluated as to whether costs are high, moderate, or low relative to other options within the same category.

The screening evaluation will generally focus on the effectiveness criterion, with less emphasis on the implementability and relative cost criteria. Technologies surviving the screening process are those that are expected to achieve the remedial action objectives for the Site, either alone or in combination with others.

3.10.1 Technical Memorandum

CDM Smith will prepare a technical memorandum and attend a meeting with EPA that describes the remedial technology screening and that includes the information summarized below.

Establish Remedial Action Objectives. Based on existing information, CDM Smith will identify site-specific remedial action objectives that should be developed to protect human health and the environment. The objectives will specify the contaminant(s) and media of concern, the exposure route(s) and receptor(s), and an acceptable contaminant level or range of levels for each exposure route (i.e., preliminary remediation goals).

Establish General Response Actions. CDM Smith will develop general response actions for each medium of interest by defining contaminant, treatment, excavation, pumping, or other actions, singly or in combination to satisfy remedial action objectives. The response actions will take into account requirements for protectiveness as identified in the remedial action objectives and the chemical and physical characteristics of the Site.

Identify and Screen Applicable Remedial Technologies. CDM Smith will identify and screen technologies based on the general response actions. Hazardous waste treatment technologies will be identified and screened to ensure that only those technologies applicable to the contaminants present, their physical matrix, and other Site characteristics will be considered. This screening will be based primarily on a technology's ability to address the contaminants at the Site effectively, but will also take into account that technology's implementability and cost. CDM Smith will select representative process options, as appropriate, to carry forward into alternative development and will identify the need for treatability testing for those technologies that are probable candidates for consideration during the detailed analysis.

Develop Remedial Alternatives in accordance with the NCP. Subsequent to the screening of the applicable remedial technologies and process options, CDM Smith will develop remedial action alternatives by combining the retained remedial technologies and process options. Remedial alternatives are developed from either stand-alone process options or combinations of the retained process options.

Screen Remedial Alternatives for Effectiveness, Implementability, and Cost. CDM Smith will screen alternatives to identify the potential technologies or process options that will be combined into media-specific or site-wide alternatives. The developed alternatives will be defined with respect to size and configuration of the representative process options, time for remediation, rates of treatment, spatial requirements, distance for disposal, required permits, imposed limitations, and other factors necessary to evaluate the alternatives. If many distinct viable options are available and developed, CDM Smith will screen the alternatives undergoing detailed analysis to provide the most promising process options.

The technical evaluations completed as part of this task will also be summarized and presented to EPA in a technical meeting following submission of the technical memorandum.

3.10.2 Final Technical Memorandum

As directed by EPA, this subtask is not applicable. EPA's review comments on the technical memorandum will be incorporated into the draft FS report as described in Section 3.12.1.

3.11 Task 11 - Remedial Alternatives Evaluation

CDM Smith will develop detailed descriptions of the individual remedial alternatives and initiate the assessment of the alternatives against each of the nine current evaluation criteria and the comparative analysis of remedial alternatives with respect to the evaluation criteria. The analysis will be consistent with the National Contingency Plan, 40 CFR Part 300 and will consider the *Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA* (EPA 1988) and other pertinent guidance.

The nine criteria are: (1) overall protection of human health and the environment; (2) compliance with applicable or relevant and appropriate requirements (ARARs); (3) long-term effectiveness; (4) reduction of toxicity, mobility, or volume; (5) short-term effectiveness; (6) implementability; (7) cost; (8) Commonwealth Acceptance; and (9) community acceptance. These evaluation criteria are detailed in Table 3-4.

Each remedial alternative will be subject to a detailed analysis according to the first seven of the nine above evaluation criteria (Commonwealth and community acceptance will be addressed later). A comparative analysis of all alternatives will then be performed to evaluate the relative benefits and drawbacks of each according to the same seven criteria.

3.11.1 Technical Memorandum

CDM Smith will meet with EPA (in lieu of a technical memorandum) to discuss the remedial alternatives and their evaluation against the evaluation criteria. The meeting will cover the following topics: (1) a technical description of each alternative will outline the waste management strategy involved and identify the key ARARs associated with each alternative; and (2) a summary of each alternative compared to the evaluation criteria. Tables will be provided that summarize the evaluations.

3.11.2 Final Technical Memorandum

As directed by EPA, this subtask is not applicable.

3.12 Task 12 - Feasibility Study Report

CDM Smith will develop a feasibility study report consisting of a detailed analysis of alternatives and a cost-effectiveness analysis, in accordance with the NCP (40 CFR Part 300) as well as the most recent guidance.

3.12.1 Draft Feasibility Study Report

CDM Smith will submit a draft FS report for OU-2 in accordance with the schedule in the approved RI/FS work plan. To expedite the completion of the report, draft chapters of the report will be submitted to the EPA RPM as they are completed. The OU-2 FS report will include the information specified below and in Table 3-5.

- FS objectives
- Remedial objectives
- General response actions
- Identification and screening of remedial technologies
- Description of remedial alternatives
- Detailed analysis of remedial alternatives
- Summary and conclusions

CDM Smith's technical feasibility considerations will address in detail any problems that may prevent a remedial alternative from mitigating Site problems; the technical feasibility of each remedial alternative will be developed considering Site characteristics outlined in the OU-2 RI Addendum. CDM Smith will address the reliability (operation over time), safety, and operation and maintenance of each alternative, the ease with which the alternative can be implemented, and the time needed for implementation.

The draft FS report will be reviewed by a CDM Smith Technical Review Committee (TRC). TRC comments will be addressed prior to submittal to EPA, and other city, commonwealth, and federal agencies, as directed by EPA, for formal review and comment.

3.12.2 Final Feasibility Study Report

After EPA's review of the draft OU-2 FS report (which will incorporate EPA review comments on the technical memorandum prepared under Subtask 3.10.1 and the meeting under Subtask 3.11.1 above), CDM Smith will prepare a response to comments letter for major comments. After EPA approves the responses, the FS report will be finalized for submittal to EPA.

3.13 Task 13 Post RI/FS Support

CDM Smith will provide technical support required for the preparation of the ROD for OU-2, excluding community involvement activities addressed under Task 2. Support activities will include the following items.

- Attendance at public meetings, briefings, and technical meetings to provide site updates
- Review of presentation materials
- Technical support for presentation of draft and final Responsiveness Summary, Proposed Plan, and ROD

- Preparation and review of a draft and final OU-2 Feasibility Study addendum (if required), based on the final ROD adopted for this OU, covering issues arising after finalization of the RI/FS documents

3.14 Task 14 - Closeout

Project closeout includes work efforts related to the project completion and closeout phase. Project records will be transferred to EPA.

3.14.1 Document Indexing

CDM Smith will organize the work assignment files in its possession in accordance with the currently approved file index structure.

3.14.2 Document Retention/Conversion

CDM Smith will convert all pertinent paper files into an appropriate long-term storage electronic format (compact disks or digital video discs [DVDs]). EPA will define the specific long-term storage format prior to closeout of this work assignment.

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Section 4

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Tables

Table 1-1
Summary of VOC Detections in Public Supply Wells
San German Groundwater Contamination Site
Operable Unit 2
San German, Puerto Rico

Well	Compound	Date	Reported Value (µg/L)	MDL (µg/L)	Party
Lola I Cased to 50 feet bgs; open hole 50-205 feet bgs (1)	cis-1,2-DCE	26-Apr-01	0.47	not listed	PRASA
		23-Jan-02	0.6	not listed	PRASA
		26-Dec-02	0.5	0.50	PRASA
		23-Oct-03	0.6	0.50	PRASA
		6-Nov-03	0.5	0.50	PRASA
		1-Jun-06	1.5	0.50	EPA
	PCE	26-Apr-01	2.4	0.50	PRASA
		26-Apr-01	2.1	not listed	PRASA
		23-Jan-02	6.4	not listed	PRASA
		23-Jul-02	1.7	not listed	PRASA
		26-Dec-02	4.2	0.50	PRASA
		24-Jan-03	1.3	0.50	PRASA
		5-May-03	1.1	0.50	PRASA
		25-Sep-03	3.4	0.50	PRASA
		23-Oct-03	5.7	0.50	PRASA
		6-Nov-03	3.2	0.50	PRASA
		12-May-04	1.4	0.50	PRASA
		19-Aug-04	2.2	0.50	PRASA
		1-Jun-06	1.6	0.50	EPA
	TCE	1-Jun-06	0.54	0.50	EPA
Lola II Cased to 49 feet bgs; open hole 49-230 feet bgs (1)	cis-1,2-DCE	29-Jan-02	0.7	not listed	PRASA
	PCE	26-Apr-01	2.5	not listed	PRASA
		26-Apr-01	2.6	0.5	PRASA
		29-Jan-02	6.2	not listed	PRASA
		26-Dec-02	4.2	0.5	PRASA
Retiro Casing/open hole interval unknown	cis-1,2-DCE	29-Jun-03	1.2	0.5	PRASA
	PCE	26-Apr-01	1	0.5	PRASA
		26-Apr-01	0.8	not listed	PRASA
		29-Jul-02	1.4	not listed	PRASA
		26-Dec-02	1	0.5	PRASA
		24-Jan-03	1.1	0.5	PRASA
		29-Jun-03	0.6	0.5	PRASA
		25-Sep-03	0.9	0.5	PRASA
		23-Oct-03	1.4	0.5	PRASA
		12-May-04	1.7	0.5	PRASA
		19-Aug-04	3.1	0.5	PRASA
		4-Dec-04	5	0.5	PRASA
		11-Mar-05	4.1	0.5	PRASA
		16-Mar-05	4	0.5	PRASA
		10-Jul-05	3.6	0.5	PRASA

(1) Based on video logging conducted during the Operable Unit 1 remedial investigation

Abbreviations:
bgs - below ground surface
cis-1,2-DCE - cis-1,2-dichloroethene
EPA - Environmental Protection Agency
MDL - method detection limit
PCE - tetrachloroethene
PRASA - Puerto Rico Aqueduct and Sewer Authority
TCE - trichloroethene
VOC - volatile organic compound
µg/L - microgram per liter

Table 1-2
Summary of OU-1 Geophysical Log Bedrock Features
San German Groundwater Contamination Site
Operable Unit 2
San German, Puerto Rico

Monitoring Well (1)	Number of Features (2)	Mean Orientation of Features	Mean Dip of Features (3)	Mean Dip Orientation of Features (3)	Dominant Feature Type
MPW-3 (MW-3R)	82	33° (NE)	82.17°	32.78° (NE)	Discontinuous hairline fracture/feature
MPW-4 (MW-4R)	60	315.85° (NW)	> 60°	NW	Discontinuous hairline fracture/feature
MPW-5 (MW-5R)	27	276.27° (W-NW)	> 60°	NW	Discontinuous hairline fracture/feature
MPW-6 (MW-6R)	62	320.88° (NW)	> 60°	NW	Discontinuous hairline fracture/feature
MPW-7 (MW-7R)	43	276.60° (W-NW)	> 60 °	W/NW	Discontinuous hairline fracture/feature
MPW-9 (MW-9R)	160	13.25° (N-NE)	23.06°	13.25° (N-NE)	Bedding/lithology change (shallow dips) and discontinuous hairline fracture/feature (steep dips)
MPW-10 (MW-10R)	81	332° (NW)	65.89°	332° (NW)	Discontinuous hairline fracture/feature
Wallace Well	19	44.53° (NE)	61.97°	44.13° (NE)	Hairline fracture/feature and bedding/lithology changes

(1) See OU-1 Remedial Investigation Report for full geophysical logs.
(2) Features include fractures, hairline fractures, discontinuous fractures, discontinuous hairline fractures, and bedding/lithology changes.
(3) MPW-4 through MPW-7 estimated from logs; details not provided by geophysical subcontractor.
Abbreviations:
° - degree
N - north
NE - northeast
NW- northwest
OU - operable unit
W - west

Table 1-3
Transmissivity and Conductivity Rates in OU-1 Bedrock Boreholes
San German Groundwater Contamination Site
Operable Unit 2
San German, Puerto Rico

Well ID	Well Depth (feet bgs)	Casing Depth (feet bgs)	Maximum Transmissivity (cm^2/sec)	Depth (feet bgs)	Maximum Conductivity (cm/sec)	Depth Interval (feet bgs)	Average Transmissivity (cm^2/sec)	Average Conductivity (cm/sec)	Comment
MPW-3	198.4	83	0.1737	105.53	0.0205	104.72-105.72	0.0295	1.70×10^{-5}	transmissive zone 100-120 feet bgs
MPW-4	193.3	118	9.8481	190.11	0.4470	189.54-190.54	1.7753	3.16×10^{-1}	transmissive zone 186-190 feet bgs
MPW-5	121.2	73	0.1108	98.33	0.0341	98.54-99.54	0.2545	5.80×10^{-2}	transmissive zones 70-78 and 98-102 feet bgs
MPW-6	199.99	88	0.5571	191.88	0.0490	191.83-192.83	0.1452	8.90×10^{-4}	transmissive zones 86-162 and 186-194 feet bgs
MPW-7	200.5	88	0.0593	193.67	0.0066	193.04-194.04	0.0853	5.47×10^{-4}	transmissive zones 92-99, 110-117, 124-144, and 193-195 feet bgs
MPW-10	200.7	78	0.4404	197.41	0.0165	197.06-198.06	0.0544	1.02×10^{-3}	transmissive zones 74-81 and 90-139 feet bgs

Abbreviations:
bgs - below ground surface
cm^2/sec - square centimeters per second
cm/sec - centimeters per second

Table 3-1
Summary of Proposed Additional Monitoring Wells
San German Groundwater Contamination Site
Operable Unit 2
San German, Puerto Rico

Data Gap #/ Description[1]	Proposed Monitoring Wells					Rationale/Objective
	Number	Location	Formation	Screen	Total Depth	
1. Down dip DNAPL in bedrock at the sources	MW-12R	North of MW-3S cluster	bedrock	100-110 ft bgs	115 ft bgs, ~10 feet into bedrock	Confirm presence/absence of DNAPL
	MW-12		saprolite	See Data Gap #5.		
3. Unstable bedrock zone	MW-3UR	MW-3/MPW-3 cluster	unstable bedrock	60-70 ft bgs	75 ft bgs	Confirm VOC concentrations in bedrock GW near greatest TCE concentrations in saprolite groundwater
	MW-4UR	MW-4S/MPW-4 cluster	unstable bedrock	55-65 ft bgs	70 ft bgs	Confirm PCE/TCE concentrations immediately downgradient of the Wallace source area
	MW-16UR	Between MW-6S & MW-7S	unstable bedrock	65-75 ft bgs	80 ft bgs	Confirm VOC concentrations in unstable bedrock in center of the elevated PCE/TCE concentration plume
	MW-14UR	Santa Marta park	unstable bedrock	45-55 ft bgs	60 ft bgs	Confirm VOC concentrations and enhance evaluation of flow direction in unstable bedrock
5. Extent of saprolite plumes	MW-12	North of MW-3S cluster	saprolite	15-25 ft bgs, near top of water table	30 ft bgs	Confirm presence/absence of VOC plume in shallowest saprolite. Coupled with bedrock well.
	MW-13	Transect location T4-0, Santa Marta	saprolite	20-30 ft bgs	35 ft bgs	Confirm VOC concentrations / Monitor saprolite groundwater near elevated PCE/TCE screening results
	MW-15	Transect location T8-00, Santa Marta	saprolite	15-25 ft bgs	30 ft bgs	Monitor groundwater near PCE detection in pore water adjacent to the Río Guanajibo.
	MW-14	Santa Marta park	saprolite	25-35 ft bgs	40 ft bgs	Determine extent of plume in saprolite groundwater. Coupled with an unstable rock well.
	MW-11	Downgradient of Lola I supply well & MW-10 cluster	saprolite	40-50 ft bgs	55 ft bgs	Identify extent of plume exceeding the MCL in saprolite

Note 1: See Section 1.4 in the Work Plan Volume 1 for a discussion of the data gaps. No additional monitoring wells are proposed to fill data gaps 2 and 4. The additional proposed monitoring wells will fill data gap 6.

Abbreviations: DNAPL – dense non-aqueous phase liquid; ft – feet (depth); MCL – maximum contaminant level; PCE – tetrachloroethene; R – stable rock well; TCE - trichloroethene; UR – unstable rock well

CDM Smith

Table 3-2
Field Sampling Program Summary
San German Groundwater Contamination Site
Operable Unit 2
San German, Puerto Rico

Task	Locations	Purpose	Analytical Parameters		Field Parameters	Total Samples[1]
			CLP	DESA		
Round 1 Monitoring Well Samples	20 single screen wells and 7 multiport wells (25 ports)	Fully delineate the PCE and TCE plumes	Trace-level TCL VOCs; SIM for vinyl chloride	MNA: chloride, methane/ethane/ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, TOC. Water quality: TSS, TDS, alkalinity, ammonia, hardness, TKN	dissolved oxygen, Eh, turbidity, temp, Fe^{3+}, cond.	45
Pore Water Samples	5 piezometers at the edge of the Río Guanajibo	Confirm groundwater/surface water interaction and groundwater discharge to surface water	Trace-level TCL VOCs; SIM for vinyl chloride	none	dissolved oxygen, Eh, turbidity, temp, Fe^{3+}, cond.	5
Surface Water Samples	5 locations in the Río Guanajibo	Confirm groundwater/surface water interaction and groundwater discharge to surface water	Trace-level TCL VOCs; SIM for vinyl chloride	none	dissolved oxygen, Eh, turbidity, temp, Fe^{3+}, cond.	5
Round 2 Monitoring Well Samples	Sampling locations to be discussed with EPA; assume 25 samples	Fully delineate the PCE and TCE plumes	Trace-level TCL VOCs; SIM for vinyl chloride	MNA: chloride, methane/ethane/ethene, nitrate/nitrite, sulfate, sulfide, ferrous iron, TOC. Water quality: TSS, TDS, alkalinity, ammonia, hardness, TKN	dissolved oxygen, Eh, turbidity, temp, Fe^{3+}, cond.	25

Notes: 1: Totals do not include QC samples

Abbreviations:

CLP - Contract Laboratory Program
cond - conductivity
DESA - Division of Environmental Science and Assessment
DO - dissolved oxygen
Eh - oxidation-reduction potential
Fe^{3+} - ferrous iron
MNA - monitored natural attenuation
PCE - tetrachloroethene
SIM - selective ion monitoring
TCL - Target Compound List
TDS - total dissolved solids
temp - temperature
TKN - total Kjeldahl nitrogen
TOC - total organic carbon
TSS - total suspended solids
VOC - volatile organic compound

Table 3-3
Proposed RI Report Addendum Format
San German Groundwater Contamination Site
Operable Unit 2
San German, Puerto Rico

1.0 Introduction
- 1.1 Purpose of Report
- 1.2 Site Background
  - 1.2.1 Site Description
  - 1.2.2 Site History
  - 1.2.3 Previous Investigations
- 1.3 Report Organization

2.0 Study Area Investigation
- 2.1 Hydrogeological Investigations

3.0 Physical Characteristics of Site
- 3.1 Topography
- 3.2 Geology
- 3.3 Hydrogeology

4.0 Nature and Extent of Contamination
- 4.1 Selection of Site-Related Contaminants
- 4.2 Screening Criteria
- 4.3 Groundwater Results and Evaluation
- 4.4 Pore Water Results and Evaluation
- 4.5 Surface Water Results and Evaluation

5.0 Contaminant Fate and Transport
- 5.1 Routes of Migration
- 5.2 Contaminant Persistence
- 5.3 Contaminant Migration

6.0 Baseline Human Health Risk Assessment (submitted separately from RI report)

7.0 Conclusions and Recommendations
- 7.1 Groundwater, Pore Water, and Surface Water Contamination
- 7.2 Recommendations

Appendices:

Well Construction Logs

Hydrogeologic Data

Analytical Data

Data Usability Evaluation

Table 3-4
Detailed Evaluation Criteria for Remedial Alternatives
San German Groundwater Contamination Site
Operable Unit 2
San German, Puerto Rico

- OVERALL PROTECTION OF HUMAN HEALTH AND ENVIRONMENT

- COMPLIANCE WITH ARARs
  - Compliance with chemical-specific ARARs
  - Compliance with action-specific ARARs
  - Compliance with location-specific ARARs
  - Compliance with appropriate criteria, advisories and guidance

- LONG-TERM EFFECTIVENESS
  - Magnitude of risk remaining at the site after the response objectives have been met
  - Adequacy of controls
  - Reliability of controls

- REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT
  - Treatment process and remedy
  - Amount of hazardous material destroyed or treated
  - Reduction in toxicity, mobility or volume of the contaminants
  - Irreversibility of the treatment
  - Type and quantity of treatment residuals

- SHORT-TERM EFFECTIVENESS
  - Protection of community during remedial action
  - Protection of workers during remedial actions
  - Time until remedial response objectives are achieved
  - Environmental impacts

- IMPLEMENTABILITY
  - Ability to construct technology
  - Reliability of technology
  - Ease of undertaking additional remedial action, if necessary
  - Monitoring considerations
  - Coordination with other agencies
  - Availability of treatment, storage capacity, and disposal services
  - Availability of necessary equipment and specialists
  - Availability of prospective technologies

- COST
  - Capital costs
  - Annual operating and maintenance costs
  - Present worth
  - Sensitivity Analysis

- COMMONWEALTH ACCEPTANCE

- COMMUNITY ACCEPTANCE

Table 3-5
Proposed Feasibility Study Report Format
San German Groundwater Contamination Site
Operable Unit 2
San German, Puerto Rico

1.0 Introduction
- 1.1 Purpose and Organization of Report
- 1.2 Site Description and History
- 1.3 Summary of the Remedial Investigation
- 1.4 Physical Characteristics of the Study Area
- 1.5 Nature and Extent of Contamination
- 1.6 Contaminant Fate and Transport and Conceptual Site Model
- 1.7 Baseline Human Health Risk Assessment

2.0 Identification and Screening of Technologies
- 2.1 Identification of Remedial Action Objectives
  - Contaminants of Interest
  - Allowable Exposure Based on Risk Assessment
  - Allowable Exposure Based on ARARs
  - Development of Remedial Action Objectives
- 2.2 Potential ARARs, Guidelines, and Other Criteria
  - Chemical-specific ARARs and TBCs
  - Location-specific ARARs
  - Action-specific ARAs and TBCs
- 2.3 Preliminary Remediation Goals
- 2.2 General Response Actions
- 2.3 Identification and Screening of Remedial Technologies and Process Options
  - 2.3.1 Description of Technologies
  - 2.3.2 Screening of Technologies

3.0 Development of Remedial Alternatives
- 3.1 Assumptions
- 3.2 Description of Remedial Alternatives
  - 3.2.1 Elements Common to all Alternatives
  - 3.2.2 No Further Action
  - 3.2.3 Alternative 1
  - 3.2.4 Alternative 2
  - 3.2.5 Alternative 3

4.0 Detailed Analysis of Alternatives
- 4.1 Description of Evaluation Criteria
  - Short-Term Effectiveness
  - Long-Term Effectiveness and Permanence
  - Implementability
  - Reduction of Mobility, Toxicity, or Volume Through Treatment
  - Compliance with ARARs
  - Overall Protection
  - Cost
  - Commonwealth Acceptance
  - Community Acceptance
- 4.2 Individual Analysis of Alternatives
- 4.3 Summary

5.0 Comparative Analysis of Alternatives
- 5.1 Comparison Among Alternatives

Figures

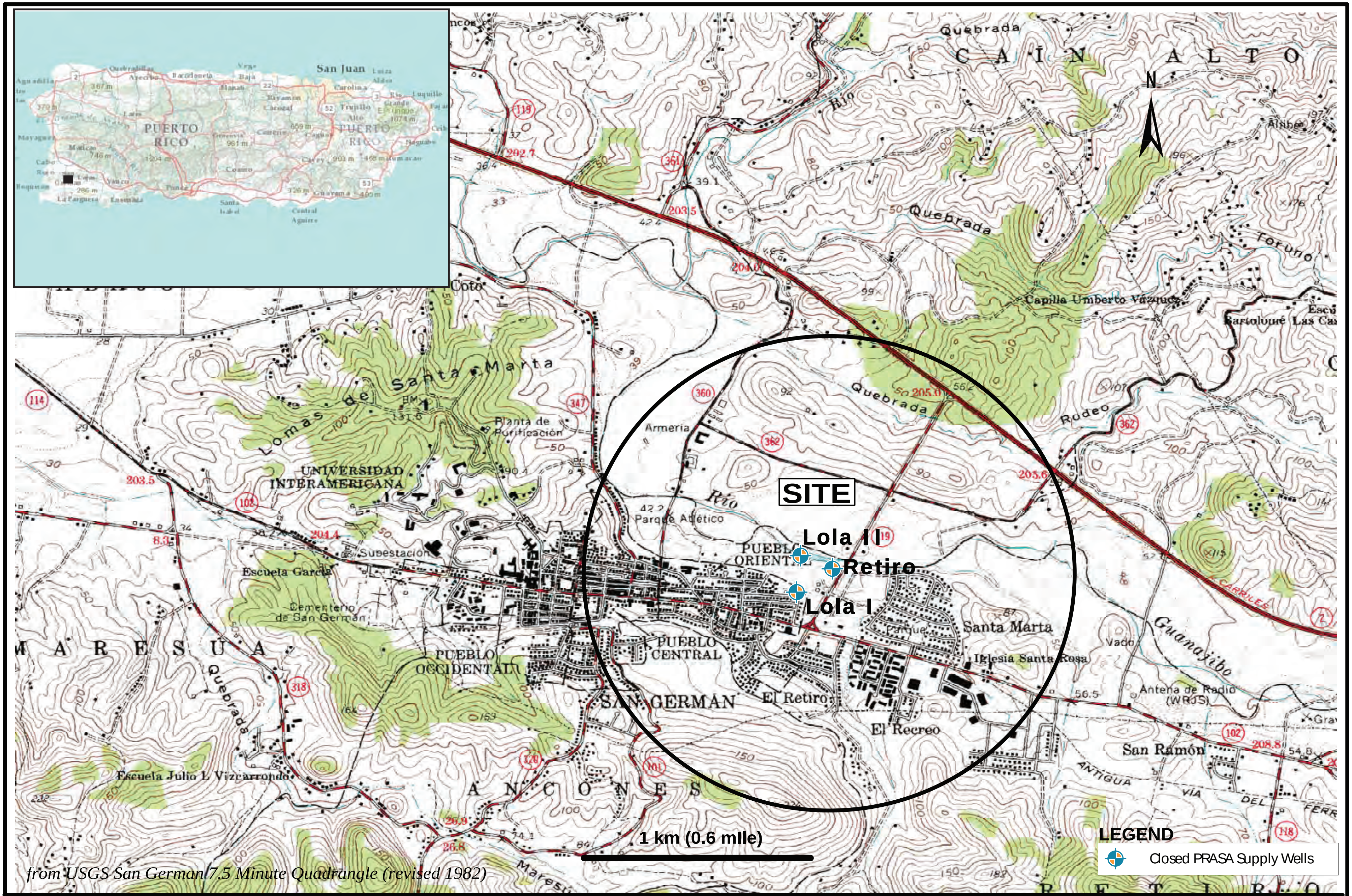

Figure 1-1
Site Location Map
San German Groundwater Contamination Site
San German, Puerto Rico

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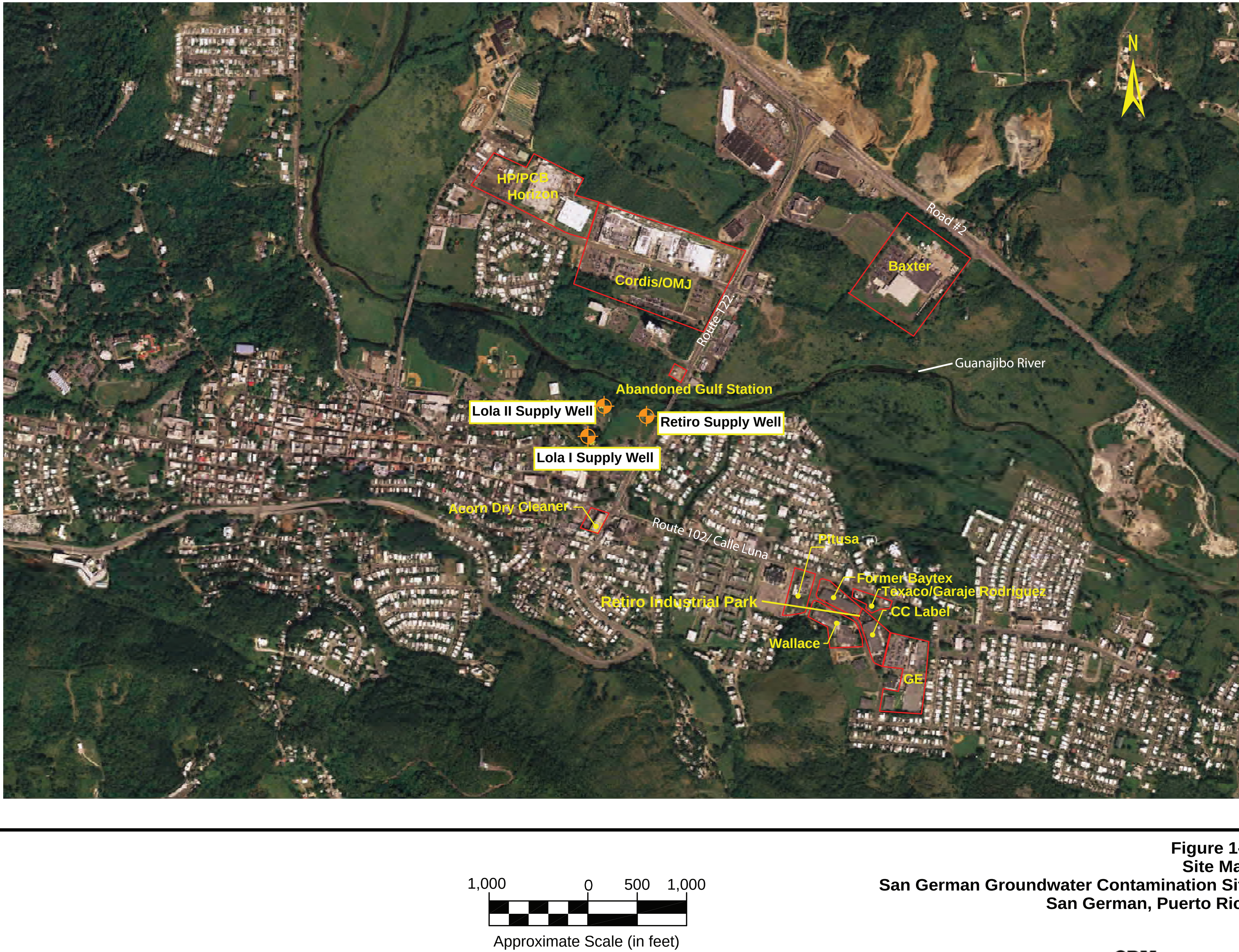

Figure 1-2
Site Map
San German Groundwater Contamination Site
San German, Puerto Rico

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Source: USGS 2007

1,000 0 500 1,000

Approximate Scale (in feet)

Figure 1-3
Local Geologic Map
San German Groundwater Contamination Site
San German, Puerto Rico

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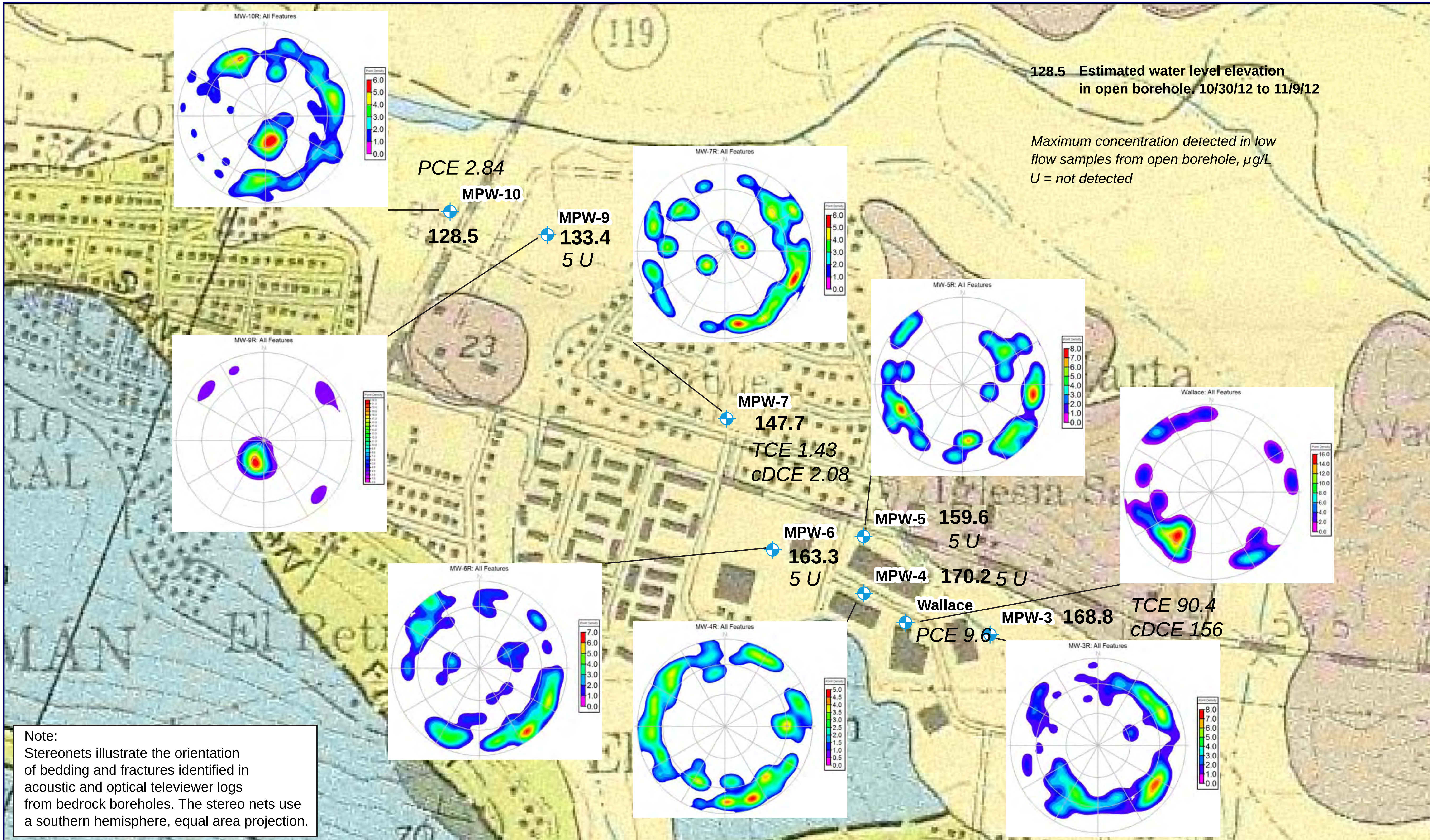

LEGEND

Bedrock Well Location

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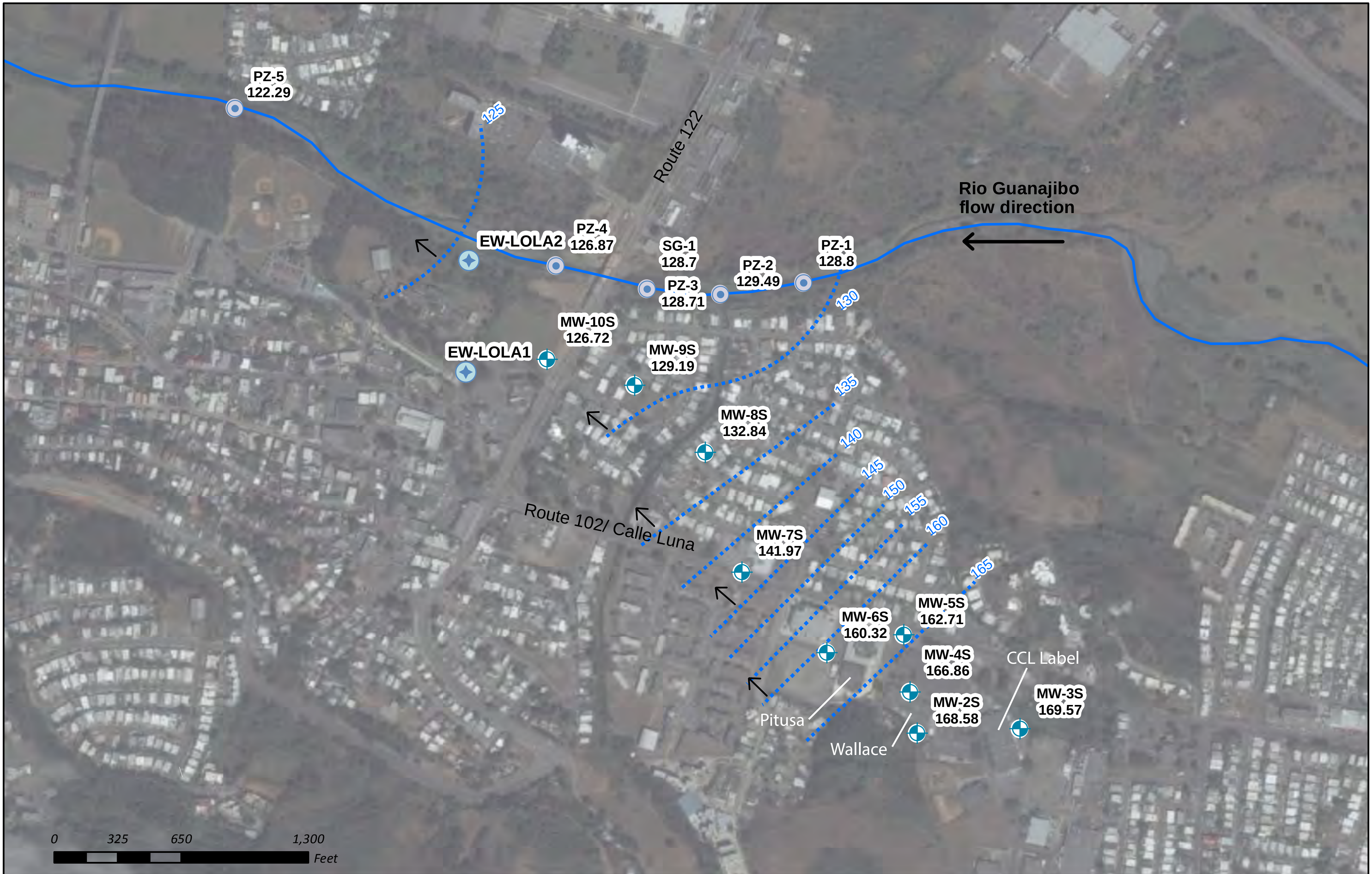
N

0 200 400 800 1,200 1,600 Feet

Figure 1-4
Bedrock Well Structural Data
San German Groundwater Contamination Site
San German, Puerto Rico



Legend

Supply Wells

Saprolite Zone Monitoring Well

Rio Guanajibo

Estimated potentiometric surface (feet amsl)

Piezometer & Staff Gauge

Groundwater flow direction

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N

Figure 1-5
Saprolite Zone Wells Potentiometric Surface
Round 1 - March 29, 2013
San German Groundwater Contamination Site
San German, Puerto Rico

Legend

Supply Wells

Bedrock Multiport Well

Rio Guanajibo

Estimated potentiometric surface (feet amsl)

Groundwater flow direction

Note: Posted water levels are from the deepest port of each multiport well

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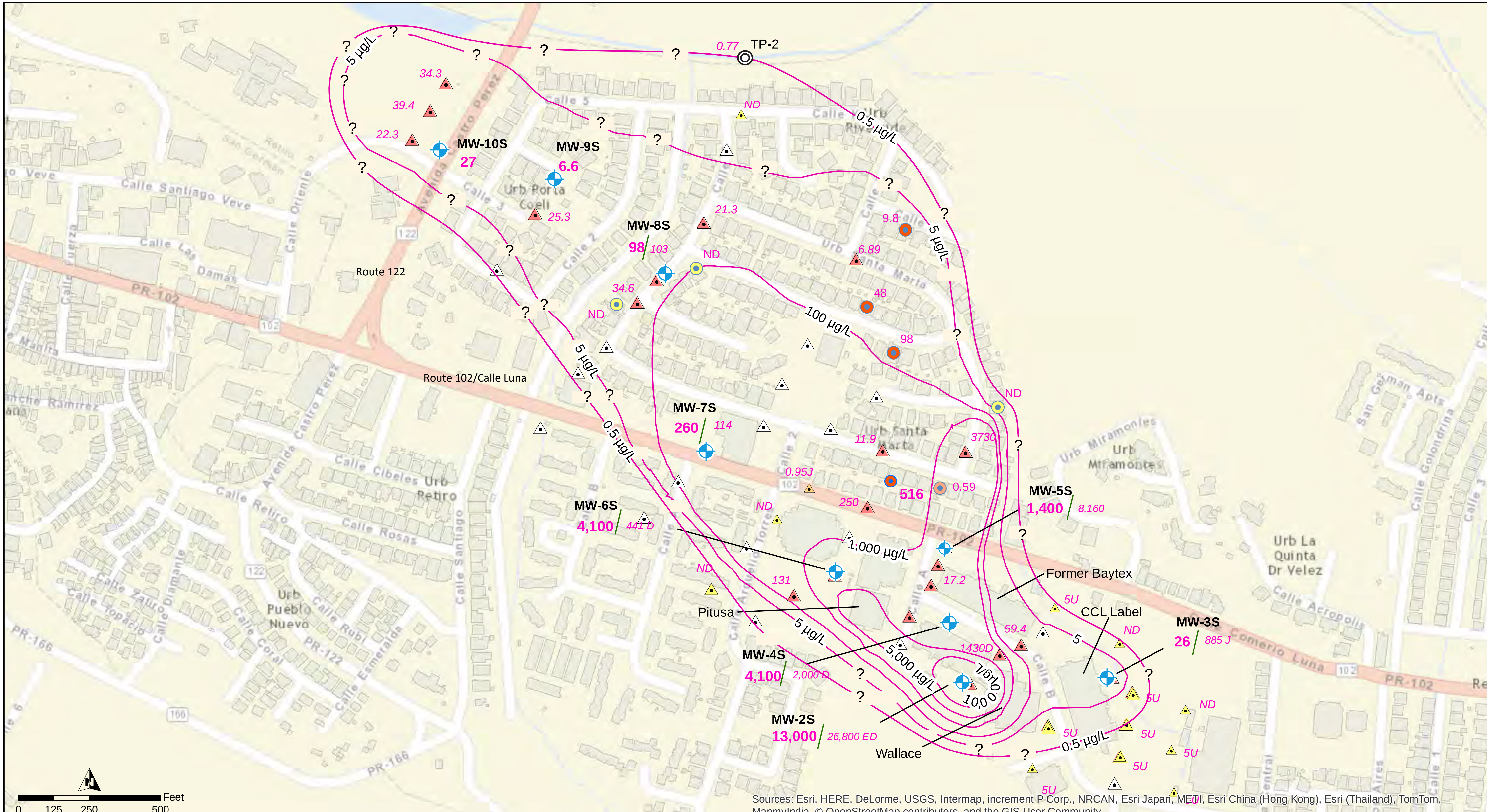
Figure 1-6
Bedrock Wells Potentiometric Surface
Round 1 - March 29, 2013
San German Groundwater Contamination Site
San German, Puerto Rico

TOMASELLIT \\nysvr1\IMS\GIS\San German\MXD\Fig_3-6_Bedrock_Water_Levels.mxd 8/14/2013



Legend

- Groundwater Screening Location having PCE concentrations above MCLs
- Groundwater Screening Location having PCE Concentrations below MCLs
- Groundwater Screening Location with no PCE detections
- Groundwater Screening Location dry
- Unconsolidated Zone Monitoring Well
- Residential Well having PCE detections
- Residential Well having no PCE detections
- ----- PCE- tetrachloroethene plume
- Piezometer location

13,000 26,800 ED - Monitoring well result / Screening result

Data Qualifiers
J - estimated
D - diluted
E - exceeds
U - undetect
ND - non detect
µg/L - micrograms per liter

Figure 1-7
PCE Saprolite Zone Groundwater Conatmination Plume
San German Groundwater Contamination Site
San German, Puerto Rico

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Legend

- Groundwater Screening Location having TCE concentrations above MCLs
- Groundwater Screening Location having TCE Concentrations below MCLs
- Groundwater Screening Location with no TCE detections
- Groundwater Screening Location dry
- Saprolite Zone Monitoring Well
- Residential Well having TCE concentrations above MCLs
- Residential Well having TCE concentrations below MCLs or ND

----- TCE- trichloroethene isocontour

14 / 5.93 - Monitoring well result / Screening result

Data Qualifiers

J - estimated
E - exceeds
D - diluted
U - undetect
µg/L - micrograms per liter
ND - non detect

Figure 1-8
TCE Saprolite Zone Groundwater Contamination Plume
San German Groundwater Contamination Site
San German, Puerto Rico

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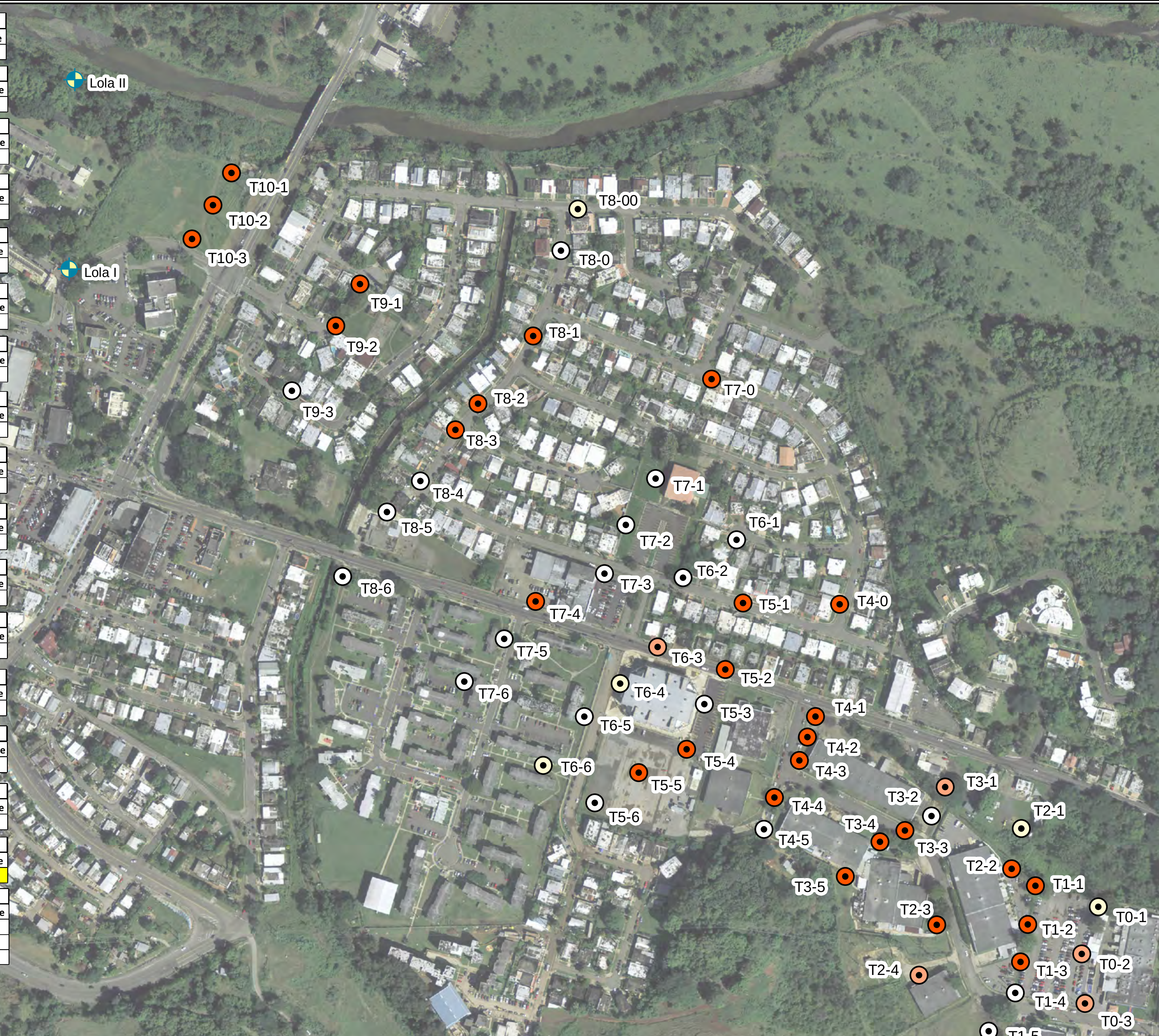

T10-1

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	32-36	**34.3**	**1.03 J**	5 U	5 U	5 U

T10-2

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	39.5-43.5	**39.4**	**0.61 J**	5 U	5 U	5 U

T10-3

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	49.2-53.2	**22.3**	**0.71 J**	5 U	5 U	5 U

T9-1

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	41-45	**35.9**	**0.87 J**	**0.97 J**	5 U	5 U

T9-2

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	32.5-36.5	**25.3**	5 U	5 U	5 U	5 U

T8-1

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	30.5-34.5	**21.3**	**8.57**	**12.9**	**0.82 J**	5 U

T8-2

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	24.7-28.7	**103**	**0.6 J**	5 U	**1.9 J**	5 U

T8-3

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	26.6-30.6	**34.6**	5 U	5 U	**0.75 J**	5 U

T7-0

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	13.8-17.8	**6.89**	**16.1**	**64.5**	**1.06 J**	5 U

T7-4

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	29.3-33.3	**114**	5 U	5 U	**1.88 J**	5 U

T6-3

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	31.8-35.8	**0.95 J**	5 U	5 U	5 U	5 U

T5-1

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	28.5-32.5	**11.9**	**2.49 J**	**2.78 J**	5 U	5 U

T5-2

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	31.8-35.8	**250**	**0.76 J**	**0.7 J**	**13.3**	5 U

T5-4

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	37-41	**441 D**	**12.2**	**1.21 J**	**3.81 J**	5 U

T5-5

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	28.5-32.5	**131**	**0.64 J**	5 U	**0.95 J**	5 U

T4-0

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	24-28	**3,730 D**	**335 D**	**203**	**42**	**6.41**

T4-1

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	7-11	**816 D**	25 U	25 U	**18 J**	25 U
	17-21	**767 D**	25 U	25 U	**21.8 J**	25 U
	27-31	**430 D**	**0.88 J**	**0.99 J**	**9.29**	5 U

T4-2

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	3 to 7	**205 D**	**2.91 J**	**1.2 J**	**4.59 J**	5 U
	13-17	**921 D**	**6.41**	**2.18 J**	**13.3**	5 U
	23-27	**1,010 D**	**6.75**	**2.42 J**	**16.4**	5 U

T4-3

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	41-45	**17.2**	**0.88 J**	5 U	5 U	5 U

T4-4

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	32-36	**2,000 D**	**11 J**	**100 U**	**17.6 J**	100 U

T3-1

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	18.6-22.6	5 U	5 U	5 U	5 U	5 U
	27.5-31.5	5 U	**1.09 J**	5 U	5 U	5 U

T3-3

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	34.5-38.5	**59.4**	**44.5**	**7.54**	**1.27 J**	5 U

T3-4

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	26.1-30.1	**1,430 D**	**43.8**	**13.7**	**20**	5 U

T3-5

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	41.2-45.2	**26,800 ED**	**5.93**	**9.54**	**126**	5 U

T2-2

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	26.5-30.5	**885 J**	**65,400 D**	2500 U	2500 U	2500 U

T2-3

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	25.1-29.1	5 U	**212**	**27**	**1.33 J**	5 U

T2-4

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	28.1-32.1	5 U	**1.44 J**	5 U	5 U	5 U

T1-1

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	33.5-37.5	5 U	**235**	**118**	5 U	**1.51 J**

T1-2

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	25.5-29.5	5 U	**107**	**26.2**	5 U	5 U

T1-3

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	17.25-21.25	5 U	**42.4**	**10.1**	5 U	5 U

T0-2

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	21.7-25.7	5 U	**2.53 J**	**0.76 J**	5 U	5 U

T0-3

Matrix	Depth (ft)	PCE	TCE	cis-1,2-DCE	1,1-DCE	Vinyl chloride
GW[1]	10.8-14.8	5 U	**1.32 J**	**2.01 J**	5 U	5 U

Screening Criterion

Matrix	PCE	TCE	cis-1,2 DCE	1,1-DCE	Vinyl Chloride
Gw (µg/L)	**5**	**5**	**70**	**7**	**0.25**
Values that exceed screening criteria are highlighted in yellow					
Values in bold represent detections					

Legend

- Groundwater Sample with SRCs above SC
- Groundwater Sample with SRCs below SC
- Groundwater Sample without SRCs detected
- Dry location
- Public Supply Well Location

Notes:

PCE- tetrachloroethene
TCE- trichloroethene
DCE - dichloroethene
GW - groundwater
ft - feet below ground surface
J - estimated value
1 concentration in micrograms per liter (µg/L)

U - not detected
E - exceed equipment calibration
D - diluted
SRCs - Site-Related Contaminants
SC - Screening Criteria
Yellow highlight indicates a detection above the screening criteria
Box results for samples with non detect SRCs are not included in map

Figure 1-9
Groundwater Transect Site-Related Contamination Results
San German Groundwater Contamination Site
San German, Puerto Rico

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Figure 2-1
San German Groundwater Contamination Site
Remedial Investigation/Feasibility Study
Operable Unit 2
Project Organization Chart

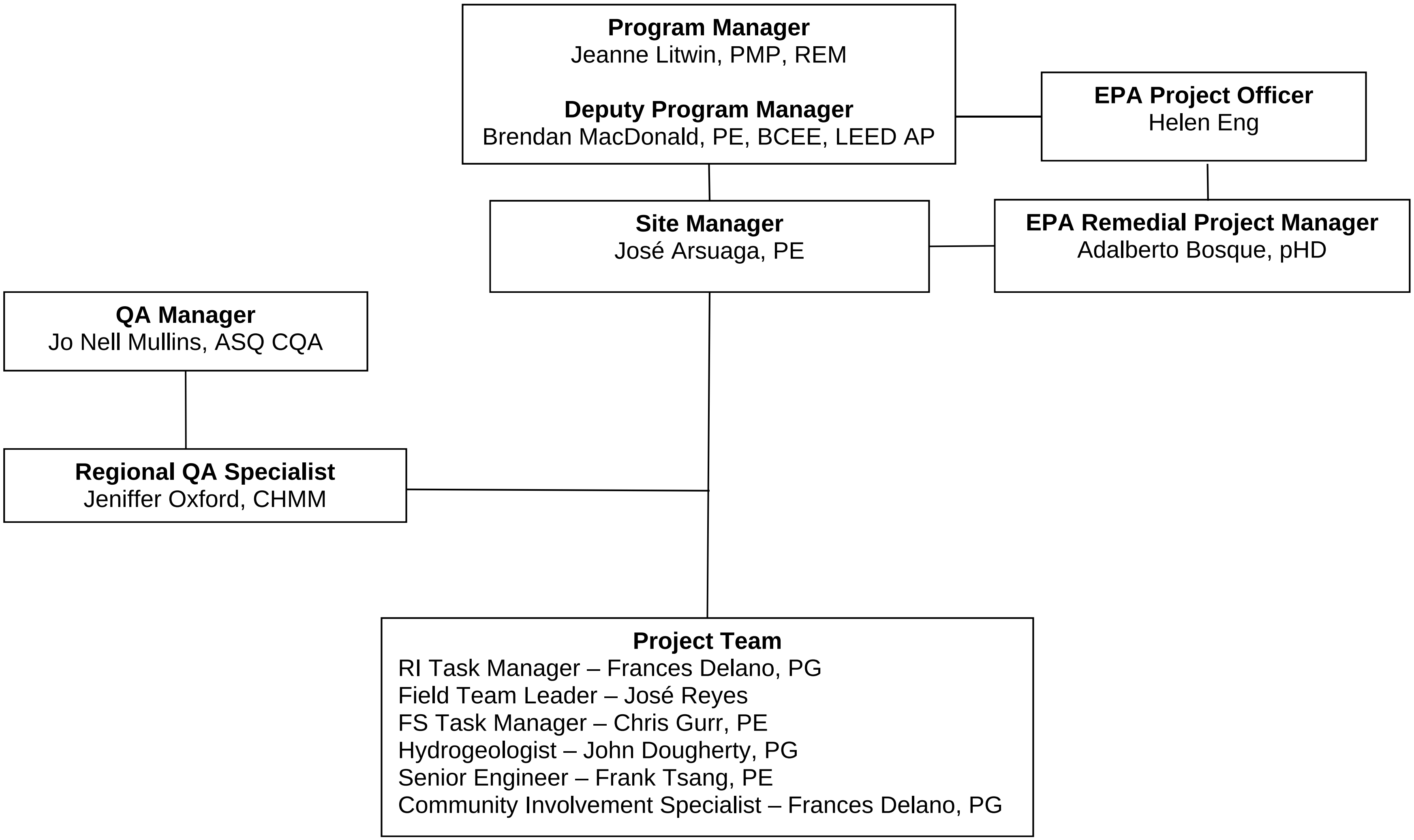

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FIGURE 2-2
PROPOSED PROJECT SCHEDULE
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAN GERMAN GROUNDWATER CONTAMINATION SITE, OU-2
SAN GERMAN, PUERTO RICO

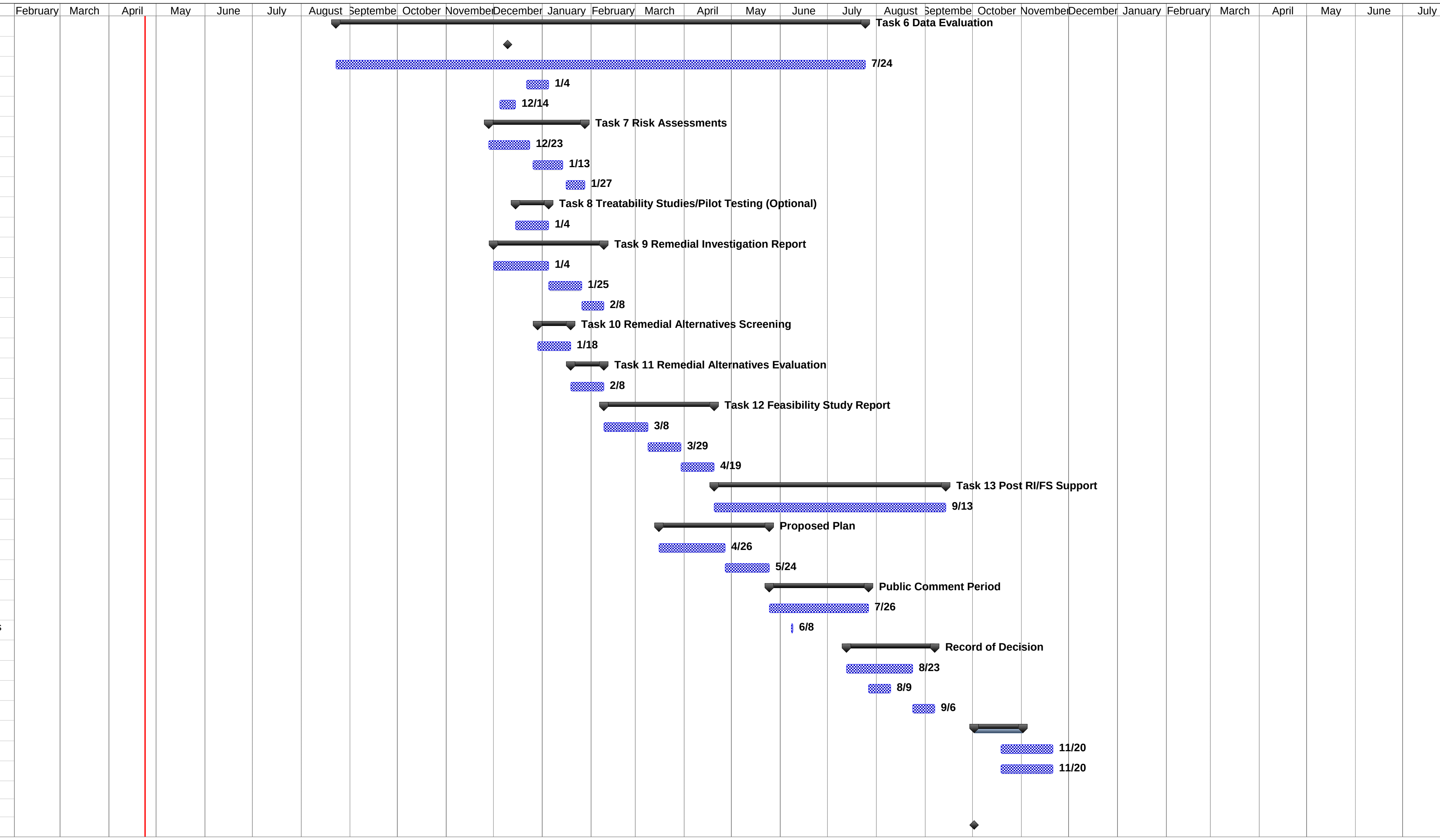
ID	Task Name	Subtask	Duration	Start	Finish	Predecessors
1	**Task 1 Project Planning and Support**	**1**	**480 days**	**Wed 3/2/16**	**Tue 1/2/18**	
2	Project Administration	1.1	480 days	Wed 3/2/16	Tue 1/2/18	
3	**Work Plan**	**1.4**	**69 days**	**Wed 3/2/16**	**Mon 6/6/16**	
4	Draft Work Plan Volumes 1 and 2	1.4	35 days	Wed 3/2/16	Tue 4/19/16	
5	EPA Review of Draft Work Plan		20 days	Wed 4/20/16	Tue 5/17/16	4
6	Submit Final Work Plan Volume 1	1.4	10 days	Wed 5/18/16	Tue 5/31/16	5
7	Negotiate Work Plan Volume 2	1.5	1 day	Wed 5/25/16	Wed 5/25/16	5FS+5 days
8	Submit Negotiated Work Plan Volume 2	1.5	8 days	Thu 5/26/16	Mon 6/6/16	7
9	**Subcontract Procurement**	**1.11**	**55 days**	**Wed 5/4/16**	**Tue 7/19/16**	
10	1. Drilling Services	1.11	35 days	Wed 5/4/16	Tue 6/21/16	6FS-4 wks
11	2. Surveying Services	1.11	20 days	Wed 6/22/16	Tue 7/19/16	6FS+3 wks
12	3. Investigation-Derived Waste Hauler	1.11	35 days	Wed 5/4/16	Tue 6/21/16	6FS-4 wks
13	**Subcontract Management**	**1.12**	**130 days**	**Wed 7/20/16**	**Tue 1/17/17**	**9**
14	**Meetings**	**1.10**	**177 days**	**Thu 9/22/16**	**Fri 5/26/17**	
15	Meeting 1 - Initial Sampling Results	1.10	1 day	Thu 9/22/16	Thu 9/22/16	49FS+30 days
16	Meeting 2 - RI Report Approach	1.10	1 day	Thu 12/8/16	Thu 12/8/16	74FS-4 wks
17	Meeting 3 - HHRA Approach	1.10	1 day	Mon 11/21/16	Mon 11/21/16	68SS-1 wk
18	Meeting 4 - Draft RI Report	1.10	1 day	Thu 1/12/17	Thu 1/12/17	74FS+5 days
19	Meeting 5 - FS Technical Meeting	1.10	1 day	Thu 1/26/17	Thu 1/26/17	78FS+5 days
20	Meeting 6 - FS Technical Meeting	1.10	1 day	Thu 2/16/17	Thu 2/16/17	80FS+5 days
21	Meeting 7 - FS Report	1.10	1 day	Thu 3/16/17	Thu 3/16/17	82FS+5 days
22	Meeting 8 - Public Meeting Preparation	1.10	1 day	Fri 5/26/17	Fri 5/26/17	92FS-2 wks
23	**QAPP**	**1.7**	**42 days**	**Wed 5/4/16**	**Thu 6/30/16**	
24	Prepare/Submit Draft QAPP Addendum	1.7	15 days	Wed 5/4/16	Tue 5/24/16	4FS+2 wks
25	EPA Review of Draft QAPP Addendum		20 days	Wed 5/25/16	Tue 6/21/16	24
26	Respond to Comments on QAPP Addendum	1.7	2 days	Wed 6/22/16	Thu 6/23/16	25
27	Prepare/Submit Final QAPP Addendum	1.7	5 days	Fri 6/24/16	Thu 6/30/16	26
28	**Task 2 Community Involvement**	**2**	**155 days**	**Thu 12/29/16**	**Wed 8/2/17**	
29	Public Availability Session #1	2.3	5 days	Thu 1/12/17	Wed 1/18/17	74FS+5 days
30	Public Meeting #2	2.3	10 days	Fri 5/26/17	Thu 6/8/17	92FS-10 days
31	Fact Sheet Preparation #1	2.4	10 days	Thu 12/29/16	Wed 1/11/17	29FS-15 days
32	Fact Sheet Preparation #2	2.4	10 days	Fri 5/19/17	Thu 6/1/17	30FS-15 days
33	Public Notice #1	2.6	10 days	Thu 12/29/16	Wed 1/11/17	29FS-15 days
34	Public Notice #2	2.6	10 days	Fri 5/19/17	Thu 6/1/17	30FS-15 days
35	Responsiveness Summary Support	2.9	5 days	Thu 7/27/17	Wed 8/2/17	91
36	**Task 3 Field Investigation**	**3**	**140 days**	**Wed 5/18/16**	**Tue 11/29/16**	
37	**Mobilization**	**3.2**	**25 days**	**Wed 5/18/16**	**Tue 6/21/16**	
38	Site Access Support	3.2	3 days	Wed 5/18/16	Fri 5/20/16	4FS+4 wks
39	Field Equipment and Supplies	3.2	5 days	Wed 6/1/16	Tue 6/7/16	10FS-3 wks
40	Site Preparation	3.2	15 days	Wed 6/1/16	Tue 6/21/16	10FS-3 wks
41	**Field Investigations**		**120 days**	**Wed 6/15/16**	**Tue 11/29/16**	
42	Inspect Condition of Existing Monitoring Wells	3.3	2 days	Wed 6/15/16	Thu 6/16/16	40FS-1 wk
43	Saprolite Monitoring Well Installation (5 wells)	3.3	10 days	Wed 6/22/16	Tue 7/5/16	40
44	Unstable Zone Monitoring Well Installation (4 wells)	3.3	12 days	Wed 7/6/16	Thu 7/21/16	43
45	Bedrock Monitoring Well Installation (1 well)	3.3	3 days	Fri 7/22/16	Tue 7/26/16	44
46	Piezometer Installation in Río Guanajibo (5 piezometers)	3.3	1 day	Wed 7/27/16	Wed 7/27/16	45
47	Surveyor Oversight (10 monitoring wells and 5 piezometers)	3.1	2 days	Thu 7/28/16	Fri 7/29/16	46
48	Synoptic Water Level Measurement (27 wells)	3.3	1 day	Mon 8/1/16	Mon 8/1/16	47
49	Round 1 Well Sampling (45 samples)	3.5	7 days	Tue 8/2/16	Wed 8/10/16	48
50	Pore Water/Piezometer Sampling (5 samples)	3.5	1 day	Thu 8/11/16	Thu 8/11/16	49
51	Surface Water Sampling in Río Guanajibo 5 samples)	3.5	1 day	Fri 8/12/16	Fri 8/12/16	50
52	Hydraulic Conductivity Testing (Slug Tests) (8 wells)	3.3	5 days	Mon 8/15/16	Fri 8/19/16	51
53	Synoptic Water Level Measurement (27 wells)	3.3	1 day	Thu 10/6/16	Thu 10/6/16	49FS+8 wks
54	Round 2 Well Sampling (25 samples)	3.5	8 days	Fri 10/7/16	Tue 10/18/16	53
55	IDW Sampling and Disposal	3.8	30 days	Wed 10/19/16	Tue 11/29/16	54
56	**Task 4 Sample Analysis**	**4**	**104 days**	**Tue 7/12/16**	**Fri 12/2/16**	
57	Analytical Services Provided via CLP or DESA	4.2	104 days	Tue 7/12/16	Fri 12/2/16	49SS-3 wks
58	Non Routine analytical Services	4.3	104 days	Tue 7/12/16	Fri 12/2/16	49SS-3 wks
59	**Task 5 Analytical Support and Data**	**5**	**100 days**	**Thu 9/22/16**	**Wed 2/8/17**	
60	Sample Management	5.2	100 days	Thu 9/22/16	Wed 2/8/17	49FS+30 days
61	Data Validation (Non-RAS) (none anticipated)	5.3	1 day	Mon 12/5/16	Mon 12/5/16	58

Project: 063_Draft WP_Figure 2-2_Sch
Date: Sun 4/24/16

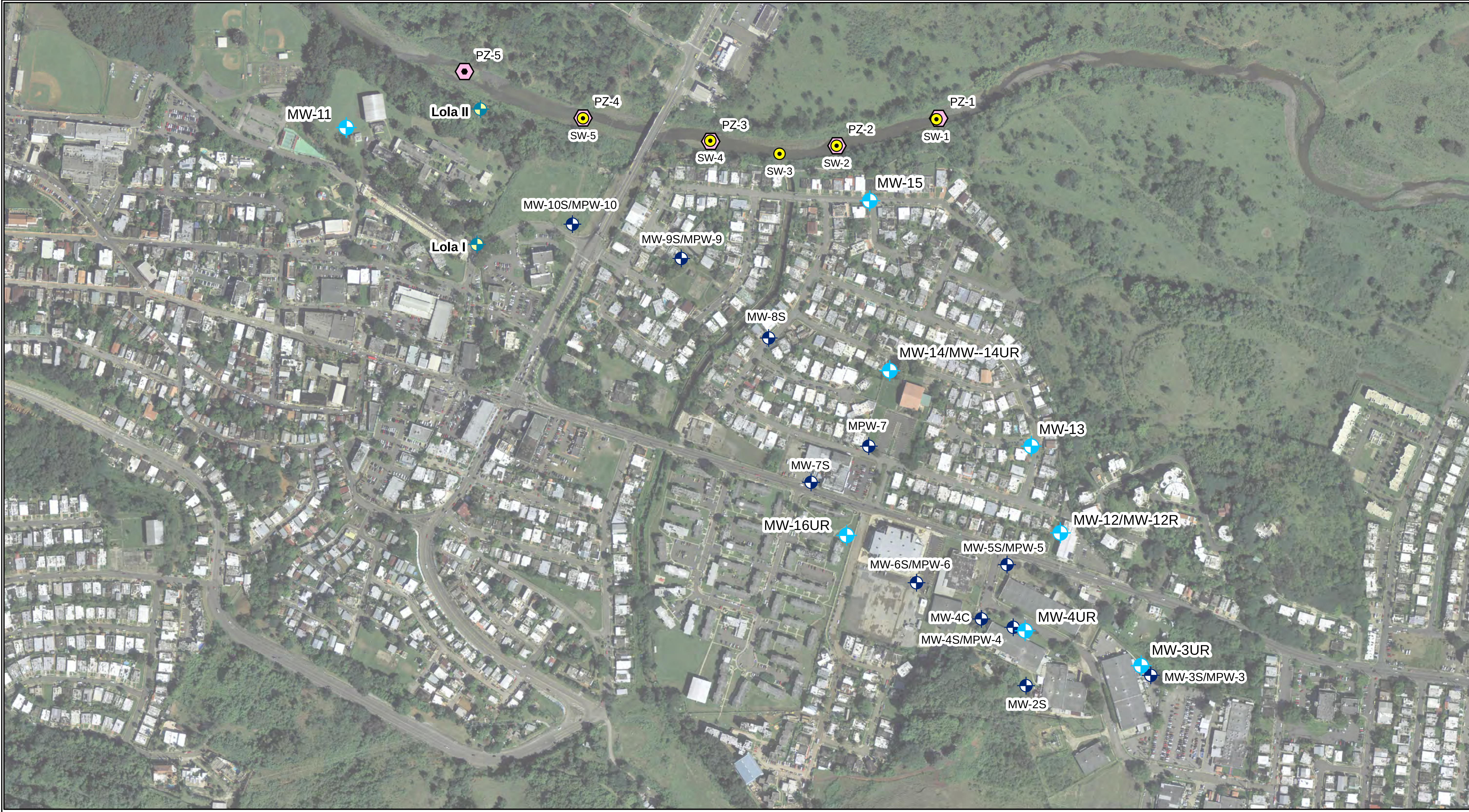
Task		Submittal		Summary		Inactive Milestone		Manual Task		Manual Summary Rollup	
Split		Meeting		Inactive Task		Inactive Summary		Duration-only		Manual Summary	
Start-only		Finish-only		Progress							

FIGURE 2-2
PROPOSED PROJECT SCHEDULE
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SAN GERMAN GROUNDWATER CONTAMINATION SITE, OU-2
SAN GERMAN, PUERTO RICO

ID	Task Name	Subtask	Duration	Start	Finish	Predecessors
62	**Task 6 Data Evaluation**	**6**	**240 days**	**Tue 8/23/16**	**Mon 7/24/17**	
63	Data Usability Evaluation	6.1	0 days	Fri 12/9/16	Fri 12/9/16	57FS+1 wk
64	Data Reduction, Tabulation and Evaluation	6.2	240 days	Tue 8/23/16	Mon 7/24/17	57SS+6 wks
65	Modeling (Optional)	6.3	10 days	Thu 12/22/16	Wed 1/4/17	74FS-2 wks
66	Data Evaluation Meeting	6.4	8 days	Mon 12/5/16	Wed 12/14/16	63FS-1 wk
67	**Task 7 Risk Assessments**	**7**	**45 days**	**Mon 11/28/16**	**Fri 1/27/17**	
68	Draft Human Health Risk Assessment Report	7.1.1	20 days	Mon 11/28/16	Fri 12/23/16	63FS-2 wks
69	EPA Review		15 days	Mon 12/26/16	Fri 1/13/17	68
70	Final Human Health Risk Assessment Report	7.1.2	10 days	Mon 1/16/17	Fri 1/27/17	69
71	**Task 8 Treatability Studies/Pilot Testing (Optional)**	**8**	**15 days**	**Thu 12/15/16**	**Wed 1/4/17**	
72	Literature Search (Optional)	8.1	15 days	Thu 12/15/16	Wed 1/4/17	74FS-15 days
73	**Task 9 Remedial Investigation Report**	**9**	**50 days**	**Thu 12/1/16**	**Wed 2/8/17**	
74	Draft Remedial Investigation Report	9.1	25 days	Thu 12/1/16	Wed 1/4/17	66FS-2 wks
75	EPA Review		15 days	Thu 1/5/17	Wed 1/25/17	74
76	Final Remedial Investigation Report	9.2	10 days	Thu 1/26/17	Wed 2/8/17	75
77	**Task 10 Remedial Alternatives Screening**	**10**	**15 days**	**Thu 12/29/16**	**Wed 1/18/17**	
78	Technical Memorandum	10.1	15 days	Thu 12/29/16	Wed 1/18/17	74FS-5 days
79	**Task 11 Remedial Alternatives Evaluation**	**11**	**15 days**	**Thu 1/19/17**	**Wed 2/8/17**	
80	Technical Meeting	11.1	15 days	Thu 1/19/17	Wed 2/8/17	78
81	**Task 12 Feasibility Study Report**	**12**	**50 days**	**Thu 2/9/17**	**Wed 4/19/17**	
82	Draft Feasibility Study Report	12.1	20 days	Thu 2/9/17	Wed 3/8/17	80
83	EPA Review		15 days	Thu 3/9/17	Wed 3/29/17	82
84	Final Feasibility Study Report	12.2	15 days	Thu 3/30/17	Wed 4/19/17	83
85	**Task 13 Post RI/FS Support**	**13**	**105 days**	**Thu 4/20/17**	**Wed 9/13/17**	
86	Technical Support	13.1	105 days	Thu 4/20/17	Wed 9/13/17	84
87	**Proposed Plan**		**50 days**	**Thu 3/16/17**	**Wed 5/24/17**	
88	EPA prepares Draft Proposed Plan to ERRD, ORC, PR		30 days	Thu 3/16/17	Wed 4/26/17	83FS-2 wks
89	Final Proposed Plan to Public		20 days	Thu 4/27/17	Wed 5/24/17	88
90	**Public Comment Period**		**45 days**	**Thu 5/25/17**	**Wed 7/26/17**	
91	Public Comment Period (60 days)		45 days	Thu 5/25/17	Wed 7/26/17	89
92	Proposed Plan Public Meeting		1 day	Thu 6/8/17	Thu 6/8/17	89FS+10 days
93	**Record of Decision**		**40 days**	**Thu 7/13/17**	**Wed 9/6/17**	
94	Draft ROD to ERRD, ORC, PR		30 days	Thu 7/13/17	Wed 8/23/17	91FS-10 days
95	Responsiveness Summary		10 days	Thu 7/27/17	Wed 8/9/17	91
96	Final ROD For Signature		10 days	Thu 8/24/17	Wed 9/6/17	94
97	**Task 14 Work Assignment Closeout**	**14**	**23 days**	**Mon 10/2/17**	**Wed 11/1/17**	
98	Document Indexing	14.1	23 days	Thu 10/19/17	Mon 11/20/17	96FS+6 wks
99	Document Retention/Converison	14.2	23 days	Thu 10/19/17	Mon 11/20/17	98SS
100						
101						
102	EPA Review		0 days	Mon 10/2/17	Mon 10/2/17	



Project: 063_Draft WP_Figure 2-2_Sch Date: Sun 4/24/16	Task	Submittal	Summary	Inactive Milestone	Manual Task	Manual Summary Rollup	Start-only	Progress
	Split	Meeting	Inactive Task	Inactive Summary	Duration-only	Manual Summary	Finish-only	



Legend

Monitoring well location

Public supply well location

Proposed monitoring well location

Temporary piezometer location

Surface water sample location

Acronyms:

MW-2S - Shallow Monitoring Well
MWP-7 - Multiport Bedrock Well
MW-14UR - Unstable rock screened monitoring well
SW - Surface water sample location

N

0 137.5 275 550 Feet

Figure 3-1
Proposed Monitoring Well, Piezometer, and Surface Water Sampling Locations
San German Groundwater Contamination Site
San German, Puerto Rico

CDM Smith